SLM R12+ Performer

Service Manual

R9010170
R9010171

R5976820/00
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BARCO

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1. SAFETY

1.1 Safety Instructions

WARNING: Before Removing/Replacing any projector components, turn off the Main Power Switch and unplug the Main AC power cable.

Safety Instructions

1. Before returning an instrument to the customer, always make a safety check of the entire instrument, including, but not limited to, the following items:
   a) Be sure that no built-in protective devices are defective and/or have been defeated during servicing. (1) Protective shields are provided on this chassis to protect both the technician and the customer. Correctly replace all missing protective shields, including any removed for servicing convenience. (2) When reinstalling the chassis and/or other assembly in the cabinet, be sure to put back in place all protective devices, including, but not limited to, insulating materials, barriers, covers/shields, and isolation resistor/capacitor networks. Do not operate this instrument or permit it to be operated without all protective devices correctly installed and functioning. Servicers who defeat safety features or fail to perform safety checks may be liable for any resulting damage.
   b) Be sure that there are no cabinet openings through which an adult or child might be able to insert their fingers and contact a hazardous voltage. Such openings include, but are not limited to, (1) excessively wide cabinet ventilation slots, and (2) an improperly fitted and/or incorrectly secured cover panels.
   c) Leakage Current Hot Check. With the instrument completely reassembled, plug the AC line cord directly into a 220 V AC outlet (Do not use an isolation transformer during this test). Use a leakage current tester or a metering system that complies with American National Standards Institute (ANSI) C101.0 Leakage Current for Appliances and Underwriters Laboratories (UL) 1410, (50.7). With the instrument AC switch first in the on position and then in the off position, measure from a known earth ground (metal waterpipe, conduit, etc.) to all exposed metal parts of the instrument (antennas, handle bracket, metal cabinet, screwheads, metallic overlays, control shafts, etc.). especially any exposed metal parts that offer an electrical return path to the chassis. Any current measured must not exceed 1.5 mA. Reverse the instrument power cord plug in the outlet and repeat test. ANY MEASUREMENTS NOT WITHIN THE LIMITS SPECIFIED HEREIN INDICATE A POTENTIAL SHOCK HAZARD THAT MUST BE ELIMINATED BEFORE RETURNING THE INSTRUMENT TO THE CUSTOMER OR BEFORE CONNECTING ACCESSORIES.

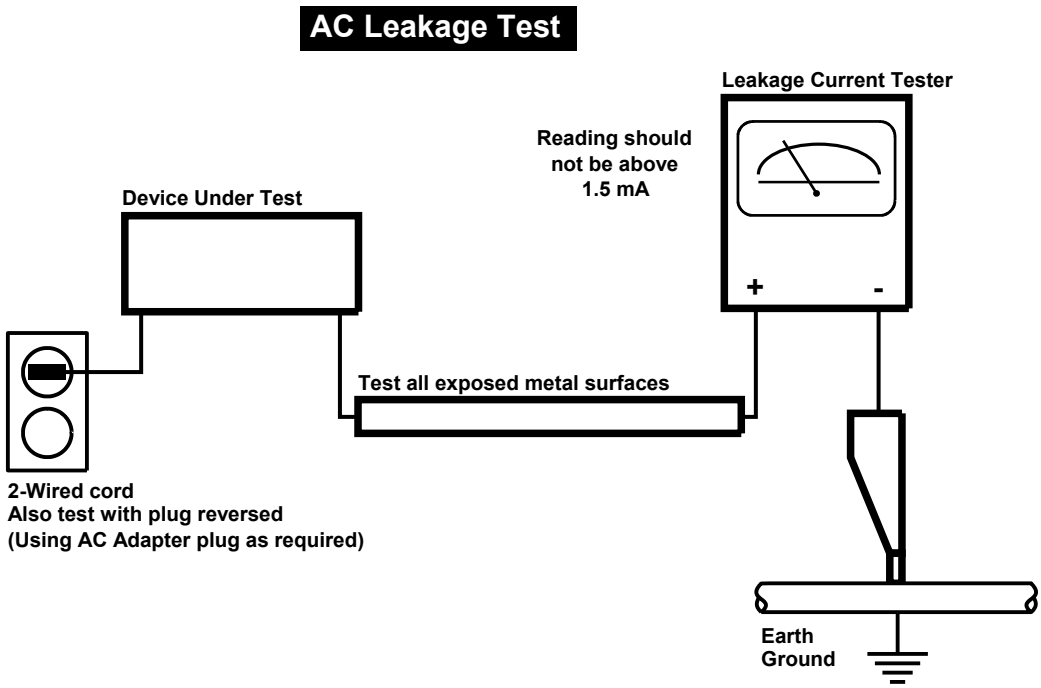

Image 1-1
AC Leakage Test

   d) Ultraviolet Radiation exposure - Warning: This lamp can cause serious skin burn and eye inflammation from shortwave ultraviolet radiation if not operated in enclosed fixtures. DO NOT operate this lamp in a fixture with a missing or broken lens cover.
   e) Ozone: Operating lamp generates ozone gas which is harmful to the respiratory system. Therefore the lamp should be operated in adequately ventilated equipment.
2. Read and comply with all caution and safety-related notes on or inside the projector cabinet or on the projector chassis, or on the picture tube.
3. Design Alteration Warning - Do not alter or add to the mechanical or electrical design of this apparatus. Design alterations and additions, including, but not limited to, circuit modifications and the addition of items such as auxiliary audio and/or video output connections, might alter the safety characteristics of this apparatus and create a hazard to the user. Any design alterations or additions may void the manufacturer's warranty and may make you, the servicer responsible for personal injury or property damage resulting therefrom.
4. Lamp explosion Protection Warning – The lamp in this projector operates with a high internal pressure and there is a slight risk that the lamp may explode, particularly if it is used beyond its rated life of 1000 hours. Do not remove, install, or otherwise handle the lamp in any manner without first putting on shatterproof goggles equipped with side shields. People not so equipped must be kept safely away while lamps are handled. Keep the lamp away from your body. For continued explosion protection, replace the lamp only with one of the same type number. Always replace the lamp before the rated life time.

5. Hot Chassis Warning - This projector chassis has two ground systems: the primary ground system is formed by the negative voltage of the rectified mains (power) and is only used as a reference in primary circuits; the secondary ground system is connected to earth ground via the earth conductor in the mains (power) lead. Separation between primary and secondary circuits is performed by the safety isolation transformers. Components bridging this transformers are also safety components and must never be defeated or altercated. All user-accessible conductive parts must be connected to earth ground, or are kept at SELV (Safety Extra Low Voltage).
6. Observe original lead dress. Always inspect in all areas for pinched, out-of-face, or frayed wiring. Do not change spacing between components, and between components and the printed-circuit board. Check AC power cord for damage. Take extra care to assure correct lead dress in the following areas:
   a) near sharp edges
   b) near thermally hot parts - be sure that leads and components do not touch thermally hot parts
   c) the AC supply
   d) high voltage
7. Components, parts, and/or wiring that appear to have overheated or are otherwise damaged should be replaced with components, parts, or wiring that meet original specifications. Additionally, determine the cause of overheating and/or damage and, if necessary, take corrective action to remove any potential safety hazard.
8. PRODUCT SAFETY NOTICE - Many electrical and mechanical parts have special safety-related characteristics some of which are often not evident from visual inspection, nor can the protection they give necessarily be obtained by replacing them with components rated for higher voltage, wattage, etc. Use of a substitute replacement that does not have the same safety characteristics as the recommended replacement part in BARCO service data parts list might create shock, fire, and/or other hazards. Product Safety is under review continuously and new instructions are issued whenever appropriate. For the latest information, always consult the appropriate current BARCO service literature.
9. Do not spray chemical on or near this instrument or any of its assemblies.
10. Electrostatically Sensitive (ES) Devices Some semiconductor (solid state) devices can be damaged easily by static electricity. Such components commonly are called Electrostatically Sensitive (ES) Devices. Examples of typical ES devices are integrated circuits and some field-effect transistors and semiconductor "chip" components. The following techniques should be used to help reduce the incidence of component damage caused by static electricity:
    a) Immediately before handling any semiconductor-equipped assembly, drain off any electrostatic charge on your body by touching a known earth ground. Wear a commercially available high impedance discharging wrist strap device.
    b) After removing an electrical assembly equipped with ES devices, place the assembly on a static dissipative surface such as a 3M No 8210 table mat, to prevent electrostatic charge buildup or exposure of the assembly.
    c) Do not use freon-propelled chemicals. These can generate electrical charges sufficient to damage ES devices.
    d) Do not remove a replacement ES device from its protective package until immediately before you are ready to install it (Most replacement ES devices are packaged with leads electrically shorted together by conductive foam, aluminium foil or comparable conductive material).
    e) Immediately before removing the protective material from the leads of a replacement ES device, touch the protective material to the chassis or circuit assembly into which the device will be installed. CAUTION: Be sure no power is applied to the chassis or circuit, and observe all other safety precautions.
    f) Minimize bodily motions when handling unpacked replacement ES devices (Otherwise harmless motion such as the brushing together of your clothes fabric or the lifting of your foot from a carpeted floor can generate static electricity sufficient to damage an ES device).

2. GENERAL INFO SLM R12+ P

2.1 Performances

Overview

SLM R12+ Performer
Compact size, powerful performance
When pure image quality matters, the Barco SLM R12+ Performer sets new standards in high-brightness projection technology.
The SLM R12+ Performer combines state-of-the-art DLP™ technology from Texas Instruments with Barco's know-how in electronics, optics and mechanical design. This results in images with an impressive light output of up to 11 500 ANSI lumens and exceptional image quality and video performance.
The SLM R12+ features a new generation SXGA+ DMD chip set with a 12 degree tilt angle. The current TLD lens range for SLM projectors has been purposely designed to be future-proof and fully compatible with this new DLP chip technology, allowing the projector to achieve higher light output at higher contrast ratio levels. The lens compatibility of the TLD lens range ensures that there is no need to invest in new lenses to take advantage of the new technology in the SLM R12+. The projector is therefore the most cost effective solution for the rental & staging industry.
Powerful performance
¥Up to 11 500 ANSI lumens
¥High-contrast level (up to 1700:1 in High Contrast Mode)
¥Exceptional video performance
¥Picture-in-Picture
¥Seamless source switching and transition effects
¥Linked CLO (Constant Light Output) matches brightness levels of SLM projectors in multiple-screen setups
Compact size
¥The smallest projector in its class
Extreme versatility
¥Wide range of analog and digital inputs
¥A choice of motorized 6click and plyð lensai
¥Extreme horizontal and vertical lens shift capabilities
¥High-Contrast Mode: trade-off between brightness and contrast, depending on your application
¥Scenergix multiple projector edge-blending option
Easy to maintain
¥Modular design with swappable parts
¥Remote control and diagnostics through optional network interface
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Image 2-1
Performances

2.2 Specifications

Overview

SLM R12+ Performer specifications

Light output [1]	11,500 Ansi		
Resolution	1,400 x 1 ,050 (na tive)		
Contrast ratio [2]	1,250:1 (ful l field)		
High Contrast Mode [3] [4]	1,700:1 (ful l field)		
Lamp	2.2kW X enon		
Lamp lif etime (ma ximum)	1,200 Hrs		
Lamp lif etime (typical)	800 Hrs		
Lamp lif etime (minimum)	500 Hrs		
Max. ambien t temperature	35¡C (95 ¡F)		
Power consump tion	2,750W		
Mains v oltage	200 - 240 V		
Weight	56 kg (124 l bs)		
Dimensions (W x L x H)	585 x 876 x 429 mm (23.0 x 34.5 x 16.9 Inch)		
FEATURES			
Scener gix	standar d hor izontal & v ertical electr onic edge blending		
Network c onnectivity	optional (10 base -T)		
Advanced pictur e in pictur e	2 sour ces simultaneous		
INPUT S			
Input sour ce compa tibility [5]	1,600 x 1 ,200 (ma x. Input)		
Fixed inputs (s tandar d)	2x configurable 5 cable (BNC) (Incl. 2 video dec oders) + 2x DVI		
Modular inputs	1x SDI (+ loop thr ough) (s tandar d) + 1x HDSDI (+ loop thr ough) (op tional)		
ORDER INFORMATION			
Projector	R9010170		
Spare lamp	R9841810		
LENSES	*throw ratio on SLM R12+ Performer*		
Fixed focal lense s	TLD HB 0.8	*0.75*	R9842040
	TLD 1.2	*1.1*	R9840770
Zoom lense s	TLD HB 1.6 - 2.0	*1.45 - 1.85*	R9842060
	TLD HB 2.0 - 2.8	*1.85 - 2.55*	R9842080
	TLD HB 2.8 - 5.0	*2.55 - 4.55*	R9842100
	TLD HB 5.0 - 8.0	*4.55 - 7.3*	R9842120

* Measured with TLD 1.2:1 lens on zen at 220 V
** Full white / full black on ful field
*** High Contrast Mode setting reduces light output to about 75%
**** Contrast ratios up to 2000:1 are possible in high contrast mode in combination with TLD lenses
***** all current video sources in composite, S-VHS, RGB or component or Serial digital format all current proposed HDTV, extended and improved television standards (1080i, 720p ...) computer and workstations with a resolution up to 1,600 x 1,200 most Macintosh computers direct digital interfacing with current and future digital standards

DLP

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Image 2-2
Specifications

3. SLM R12+ P - PARTS

Spare abbreviation

Abbreviation	Definition
NR	Non repairable
CO	Consumable
FR	Factory Repairable
LR	Locally repairable

3.1 SLM R12+ P - List of Modules

Control Panel - Overview modules

Art. Number	Order Number	Description	Spare abbreviation			
			NR	CO	FR	LR
R763223		Local keypad + LCD Display				
R763279		LCD Display				
R763768		Communication Unit				
R763090		Communication Display				
R763766		Communication Interface				

Signal Input - Overview Modules

Art. Number	Order Number	Description	Spare abbreviation			
			NR	CO	FR	LR
R7632485	**R9840110**	SDI Input (standard)				
R763850		Input Selection 1/2 (standard)				
R763851		Input Selection 2/2 (standard)				
R763291	**R9840450**	HDTV-SDI Input (optional)				
R763790	**R9841170**	(S)-Video Input +Decoder ((optional)				

Signal Processing - Overview Modules

Art. Number	Order Number	Description	Spare abbreviation			
			NR	CO	FR	LR
R763261		Infra Red Receiver (Front & Rear)				
R763826		Digital Decoder				
R764115		Pixel Map Processor (PMP)				
R7638858		CPU				
R764346		Formatter Interface board (FIB)				

Light Engine - Overview Modules

Art. Number	Order Number	Description	Spare abbreviation			
			NR	CO	FR	LR
R840527	**R840527k**	Light Engine Complete				
R764423		DLP 3CH SXGA+ Unit Blue				
R764596		Formatter FTP* Blue				
R764422		DLP 3CH SXGA+ Unit Green				
R764595		Formatter FTP* Green				
R7644221		DLP 3CH SXGA+ Unit Red				
R7645951		Formatter FTP* Red				
R764346		Formatter Interface board (FIB)				

* **Fast track Pixel**

Power Supply - Overview Modules

Art. Number	Order Number	Description	Spare abbreviation			
			NR	CO	FR	LR
R764349		Switch Mode Power Supply				
R763512		Start Pulse Generator				
R7632245S		Start Pulse Generator Sub/2				
R7633705		Lamp Power Supply-Xenon Mech/5				
R7632113		Lamp Power Supply-Xenon In/Out/3				
R7632105		Lamp Power Supply-Xenon Proc/5				

Misceleneous

Art. Number	Order Number	Description	Spare abbreviation			
R762790		Temperature Sensor				
R763604		Remote Control Complete (RC5)				
R763569		Remote Control board				
R763294		Ambient Light Sensor				
R763295		Lamp Info board				
R764240		Tilt switch				
R764239		Backplane Electronic box				
R763378		Backplane Electronic box (Inputs)				

3.2 SLM R12+ P - List of Kits

Overview

Order Number	Description	Publication Reference
R840527K	Light Engine Complete	R5976786
R8454096K* R84540924k*	Framed Air Filter (6 pack) Framed Air Filter (24 pack)	x x x x x x x
R9841812	Lamp unit replacement	R5976754
R9841170	Digital Video Input	R5976226
R9840450	HDTV-SDI Input	R5976226
R9841200	Network	R5976325
R9841180	Toolkit	R5976290
R9841080	Ceiling Mount 100 adapter plate	R5976313
R9841010	Ceiling Mount 100 with Pulley	R5976359
R9841011	Ceiling Mount 100 without Pulley	R5976359
R9840840	Multi-funtional Frame	R5976259
R9898215	Stackable Frame	R5976400
R847196K	Re-convergence Toolkit	R5976814
R9840170	Rugged Remote Control	R5976251
R9840172	Wireless Receiver	R5976348
R9840171	Wireless Rugged Remote Control	R5976251

* **For the SLM R9+ only**

3.3 SLM R12+ P - List of Lenses

Overview TLD High Brightness Lenses

Lens Reference	Metric formulas (meter)	Inch formulas (inch)
TLD HB(0.8:1)	PD=0.77xSW+0.05	PD=0.77SW+1.97
TLD HB(1.2:1)	PD=1.11xSW-0.01	PD=1.11xSW-0.39
TLD HB(1.6–2.0:1)	PD_{min}=1.47xSW-0.09 PD_{max}=1.85xSW-0.13	PD_{min}=1.47xSW-3.54 PD_{max}=1.85xSW-5.12
TLD HB(2.0–2.8:1)	PD_{min}=1.85xSW-0.17 PD_{max}=2.62xSW-0.24	PD_{min}=1.85xSW-6.69 PD_{max}=2.62xSW-9.45
TLD HB(2.8–5.0:1)	PD_{min}=2.58xSW-0.16 PD_{max}=4.71xSW-0.38	PD_{min}=2.58xSW-6.30 PD_{max}=4.71xSW-14.96
TLD HB(5.0–8.0:1)	PD_{min}=4.52xSW-0.01 PD_{max}=7.53xSW-0.29	PD_{min}=4.52xSW-0.39 PD_{max}=7.53xSW-11.42

Overview TLD Lenses

Lens Reference	Metric formulas (meter)	Inch formulas (inch)
TLD(0.8:1)	PD=0.77xSW+0.05	PD=0.77SW+1.97
TLD(1.2:1)	PD=1.11xSW-0.01	PD=1.11xSW-0.39
TLD(1.6–2.0:1)	PD_{min}=1.47xSW-0.09 PD_{max}=1.85xSW-0.13	PD_{min}=1.47xSW-3.54 PD_{max}=1.85xSW-5.12
TLD(2.0–2.8:1)	PD_{min}=1.85xSW-0.17 PD_{max}=2.62xSW-0.24	PD_{min}=1.85xSW-6.69 PD_{max}=2.62xSW-9.45
TLD(2.8–5.0:1)	PD_{min}=2.58xSW-0.16 PD_{max}=4.71xSW-0.38	PD_{min}=2.58xSW-6.30 PD_{max}=4.71xSW-14.96
TLD(5.0–8.0:1)	PD_{min}=4.52xSW-0.01 PD_{max}=7.53xSW-0.29	PD_{min}=4.52xSW-0.39 PD_{max}=7.53xSW-11.42

4. SLM R12+ P - LOCATION OF THE MODULES

Convention - Projector Orientation

Image 4-1
Projector orientation

4.1 Projector side - Left

Identification

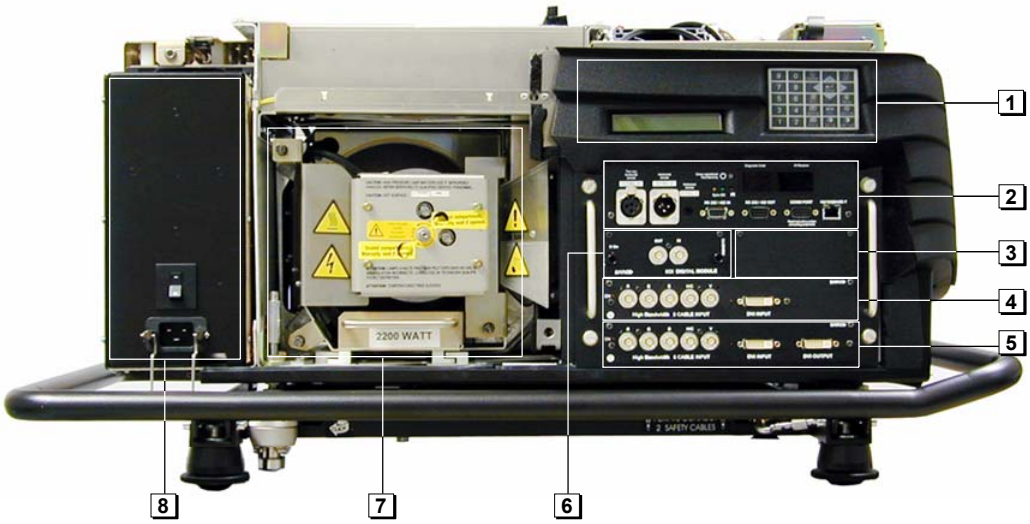


Image 4-2
Module identification - left side

Picture Ref.	Art. No	Identification	Manual Page
1	R763223	Local Key Panel +LCD Display	
2	R763768	Communication Interface & Display	
3	R813245	Dummy plate	
4	R763850	Input Selector 1/2	
5	R763851	Input Selector 2/2	
6	R7632485	SDI Input	
7	R9841812	Lamp Unit 2200W	
8	R822478	Power Input & Power Switch Complete	

4.2 Projector side - Right

Identification

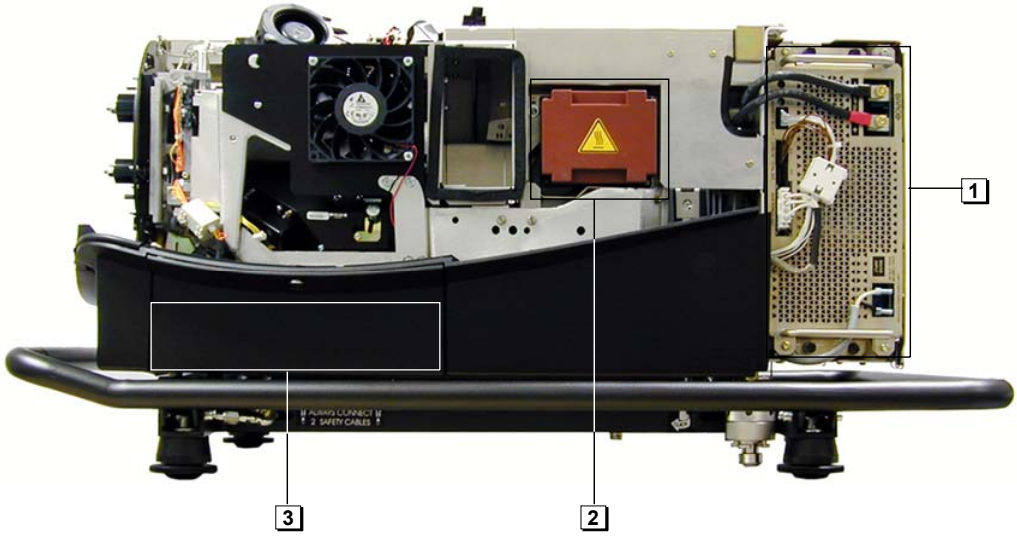


Image 4-3
Module identification - right side

Picture Ref.	Art. No	Identification	Manual page
1	R7633705*	Lamp Power Supply	
2	R763512	Start pulse Generator	
3	R764349	Switch Mode Power Supply	

*** Unit article number exclusive modules**

4.3 Projector - Electronic Box

Local Keypad & LCD Display

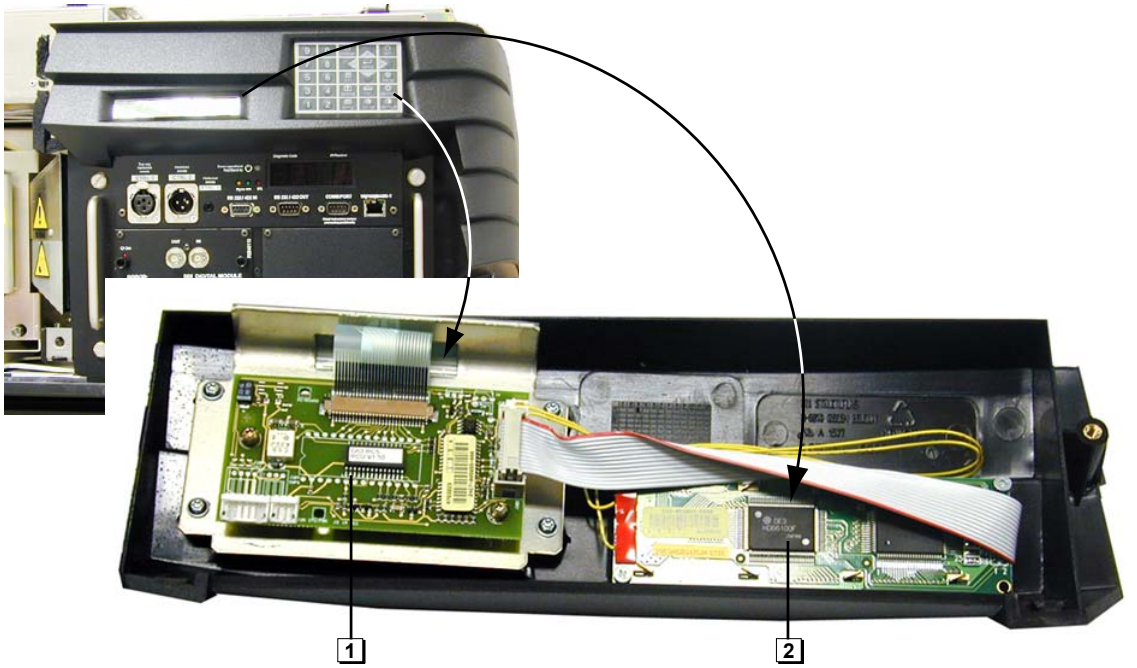


Image 4-4
Local Keypad & LCD Panel

Picture Ref.	Art. No	Identification	Manual page
1	R763223	Local key pad	
2	R763279	LCD Display	

Communication Interface

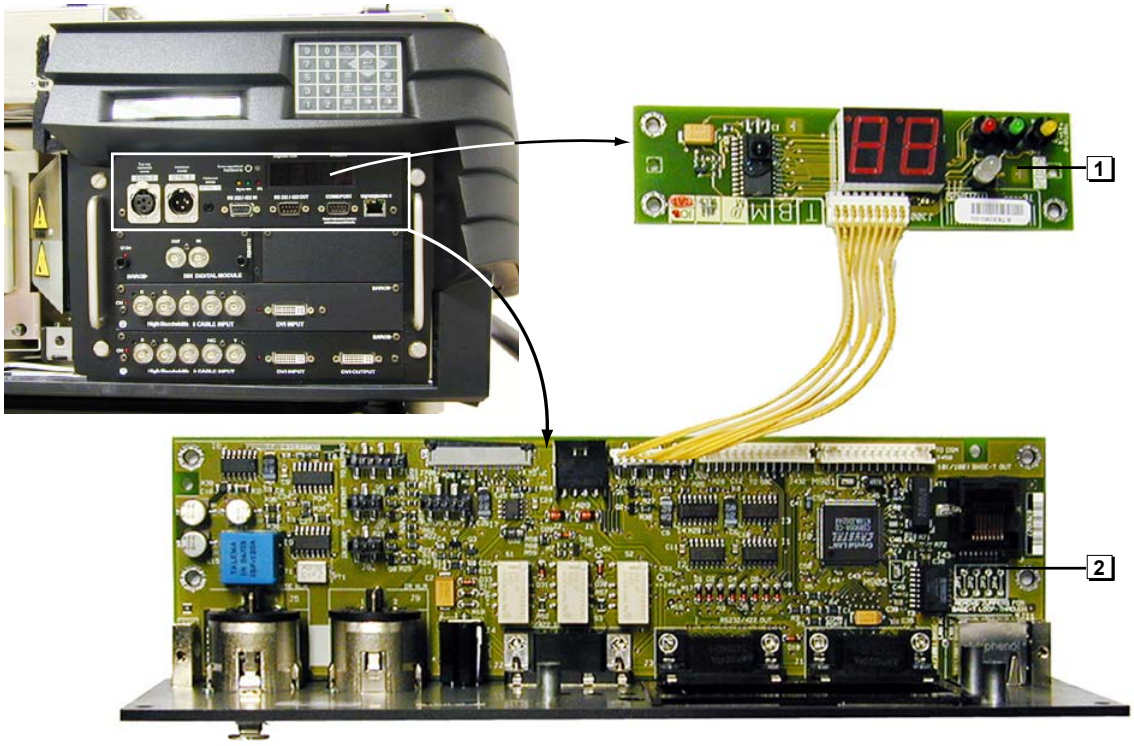


Image 4-5
Communication Interface

Picture Ref.	Art. No	Identification	Manual page
1	R763090	Communication Display	
2	R763766	Communication Interface	

SDI Input

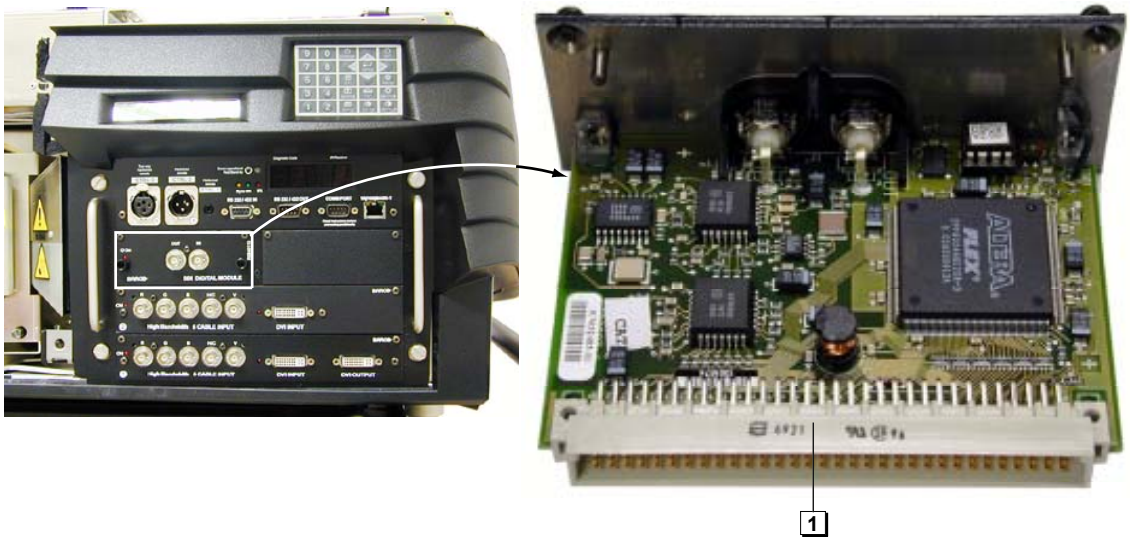


Image 4-6
SDI Input

Picture Ref.	Art. No	Identification	Manual page
1	R7632485	SDI Input	

Input Selector 1/2 & Digital Decoder

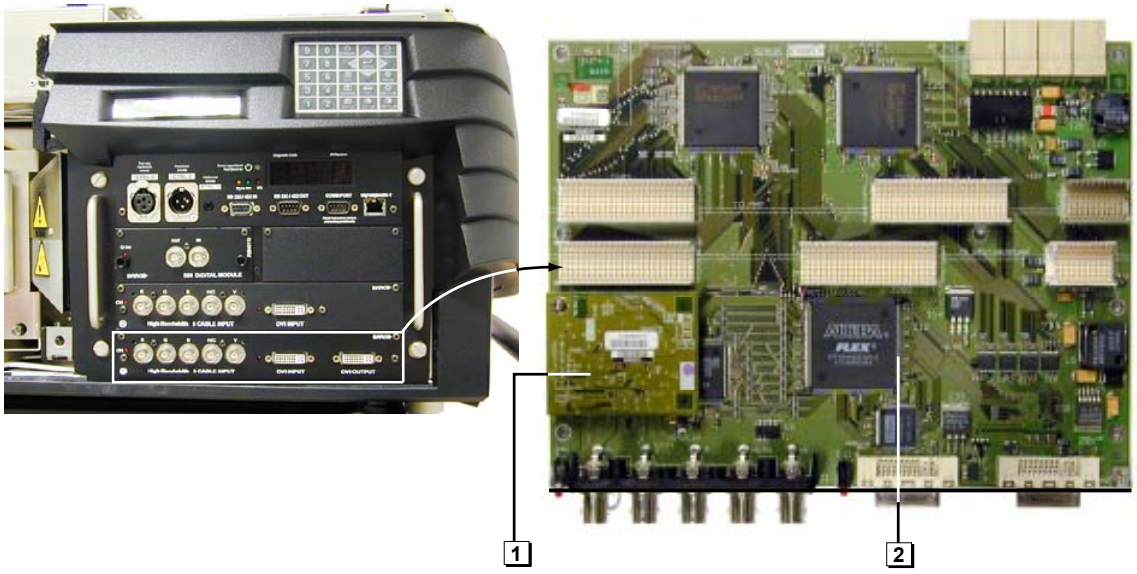


Image 4-7
Input selector 1/2

Picturer Ref.	Art. No	Identification	Manual page
1	R763826	Digital Decoder	
2	R763850	Input Selector 1/2	

Input Selector 2/2 & Digital Decoder

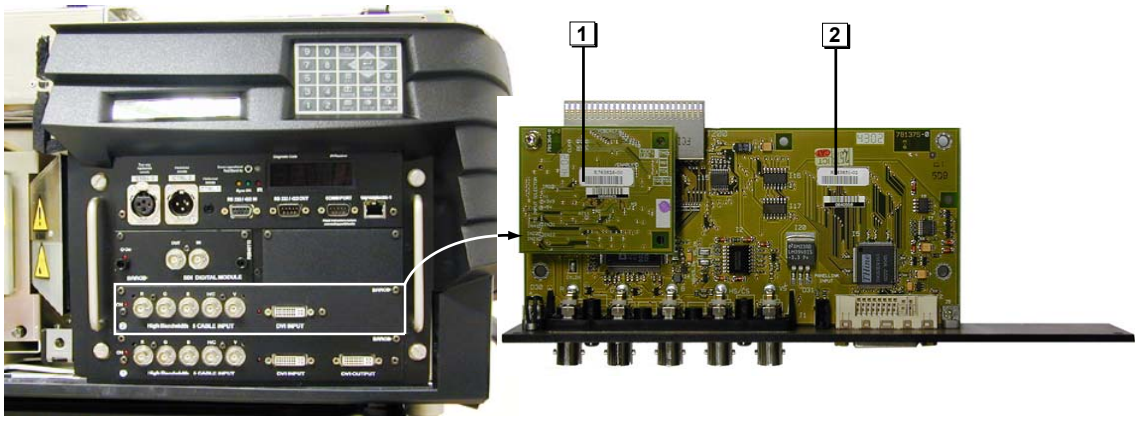


Image 4-8
Input selector 2/2

Picture Ref.	Art. No	Identification	Manual page
1	R763826	Digital Decoder	
2	R763851	Input Selector 2/2	

CPU & Backplane Digital Inputs

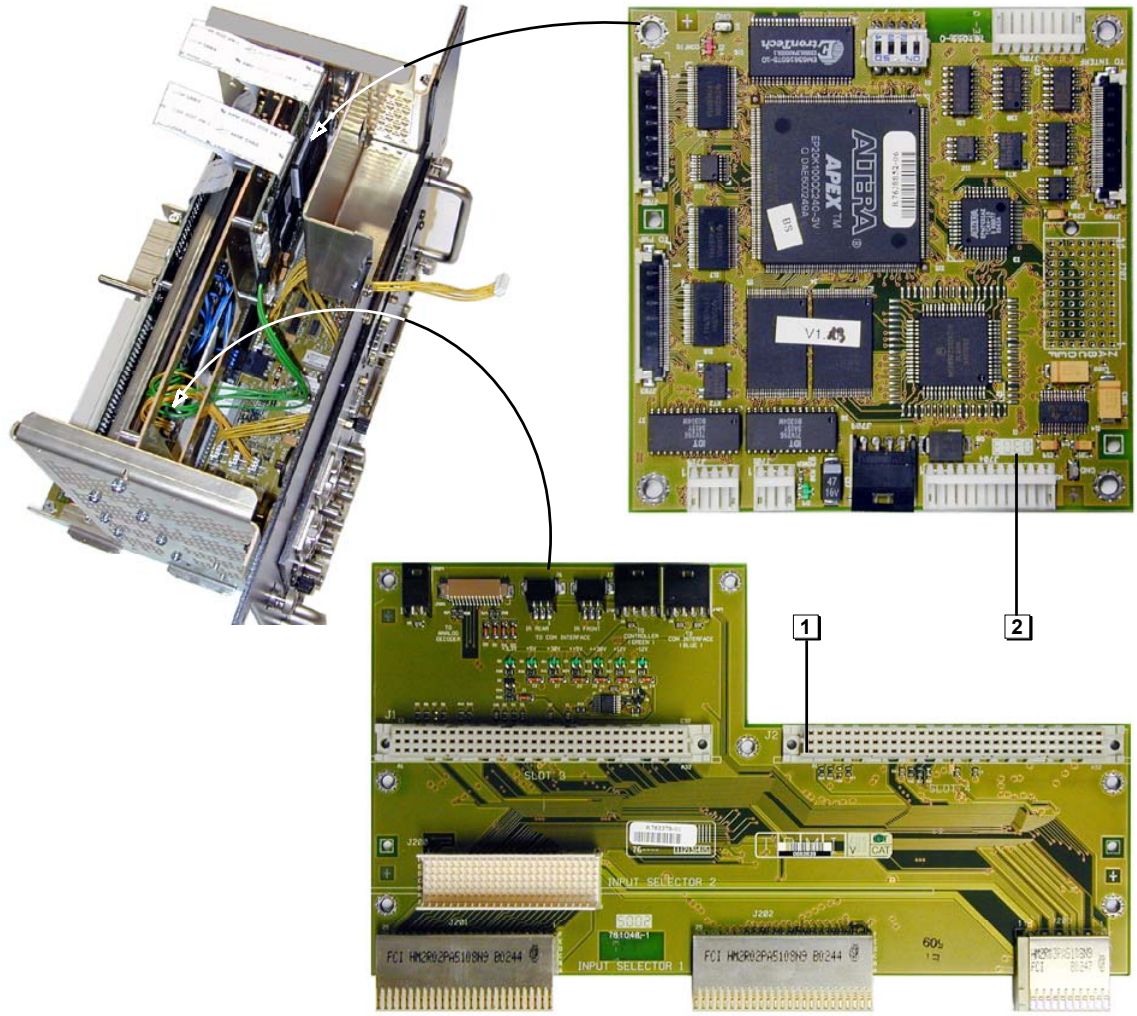


Image 4-9
CPU & Digital backplane

Picture Ref.	Art. No	Identification	Manual page
1	R763378	Digital Backplane	
2	R7638857	CPU	

Pixel Map Processor (PMP)

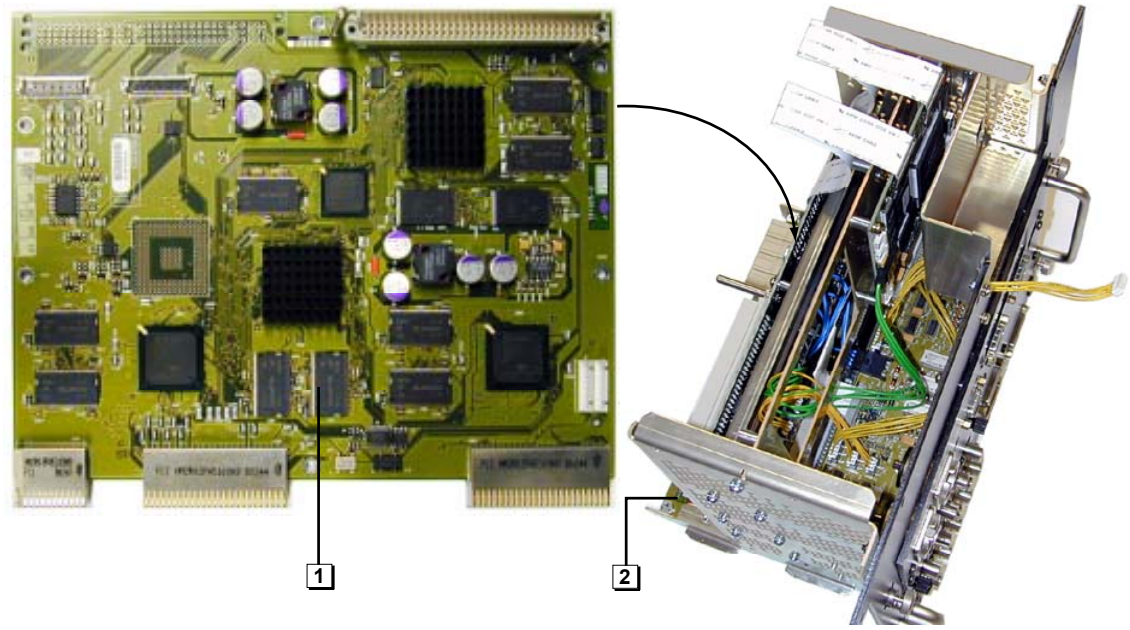


Image 4-10
Pixel Map Processor

Picture Ref.	Art. No	Identification	Manual page
1	R763348	Pixel Map Processor (PMP)	
2	R763850	Input Selector 1/2	

FIB - Temp & Motor Control - Power Backplane

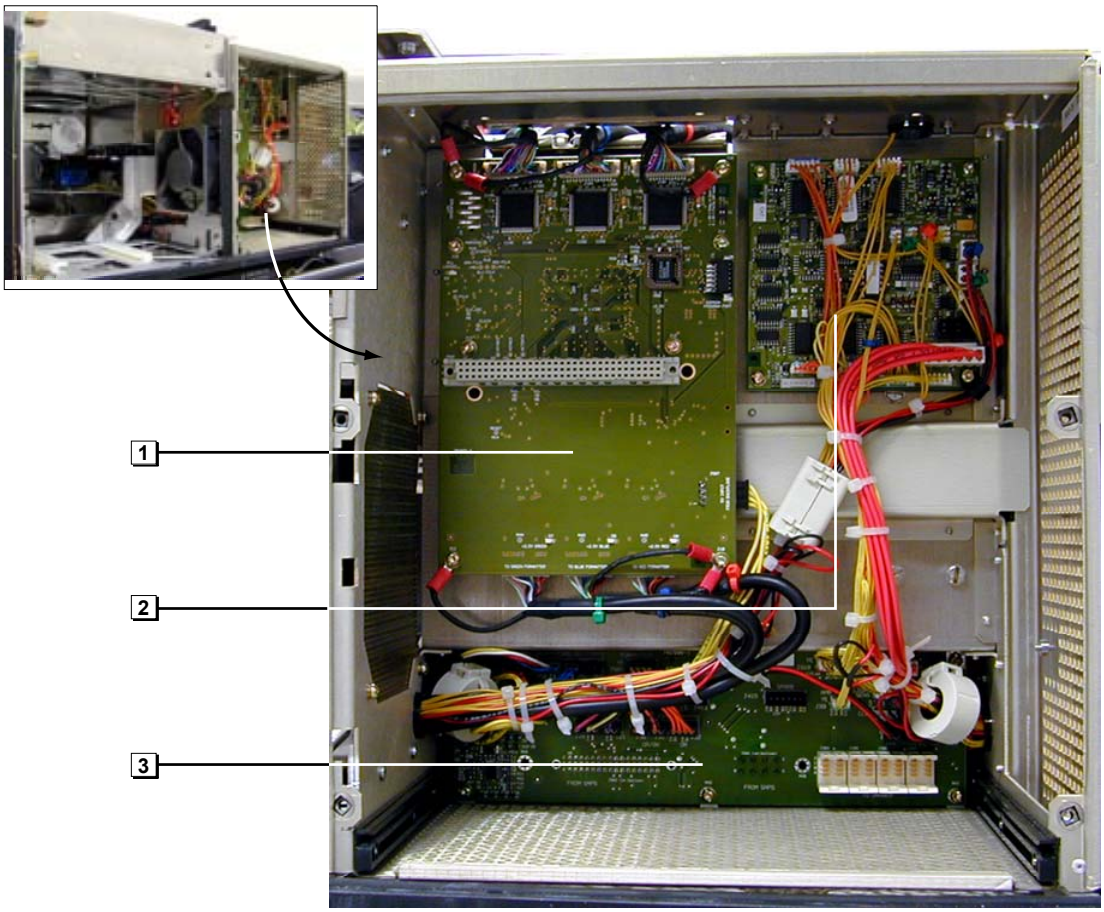


Image 4-11
FIB - Temp & Motor Control - Power Backplane

Picture Ref.	Art. No	Identification	Manual page
1	R764346	Formatter Interface board	
2	R764203	Temp. & Motor Control board	
3	R764239	Power Backplane	

IR Receivers & Temperature Sensor

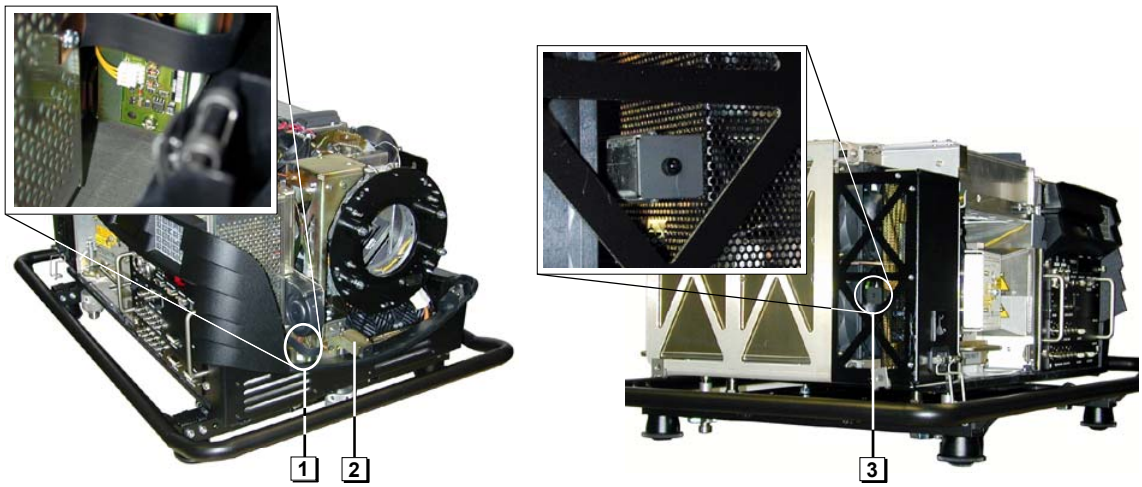


Image 4-12
IR receiver Front & Rear - Temp. Sensor

Picture Ref.	Art. No	Identification	Manual page
1	R762790	Ambient Temperature Sensor	
2	R763261	IR Receiver 'Front'	
3	R763261	IR Receiver 'Rear'	

Start Pulse Generator - Light Sensor

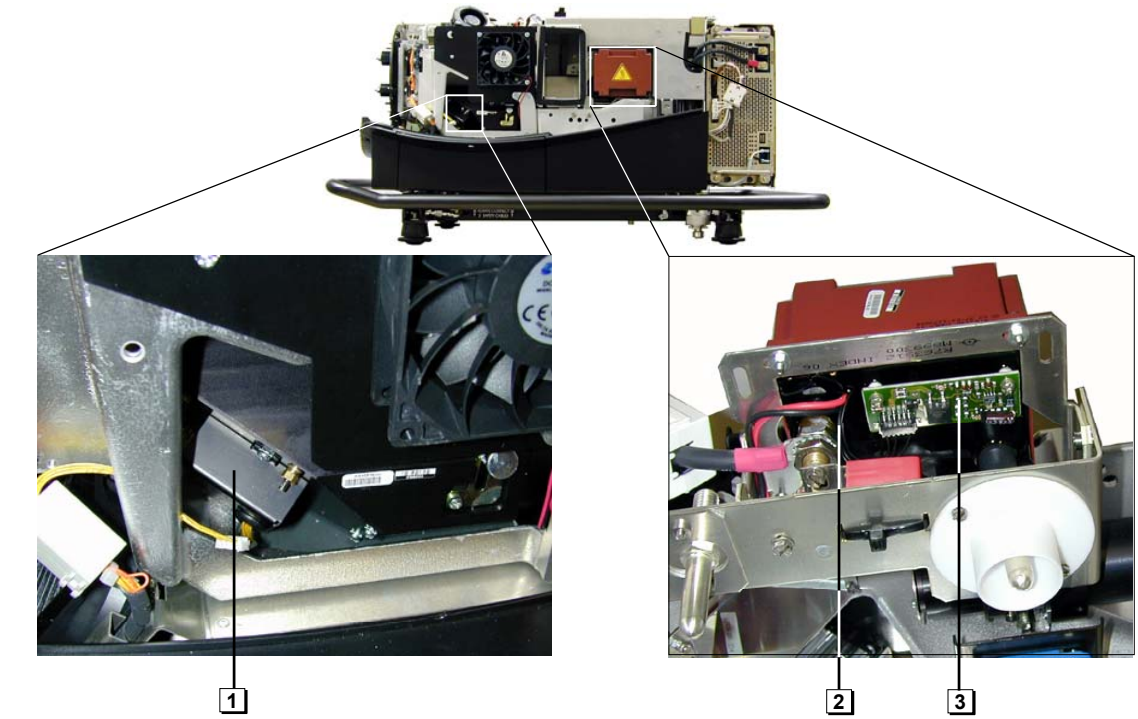


Image 4-13
Start Pulse Generator & Light sensor

Picture Ref.	Art. No	Identification	Manual page
1	R763294	Light Sensor	

Picture Ref.	Art. No	Identification	Manual page
2	R763512	Start Pulse Generator Complete	
3	R7632245s	Start Pulse Generator Sub/2	

Switch Mode Power Supply

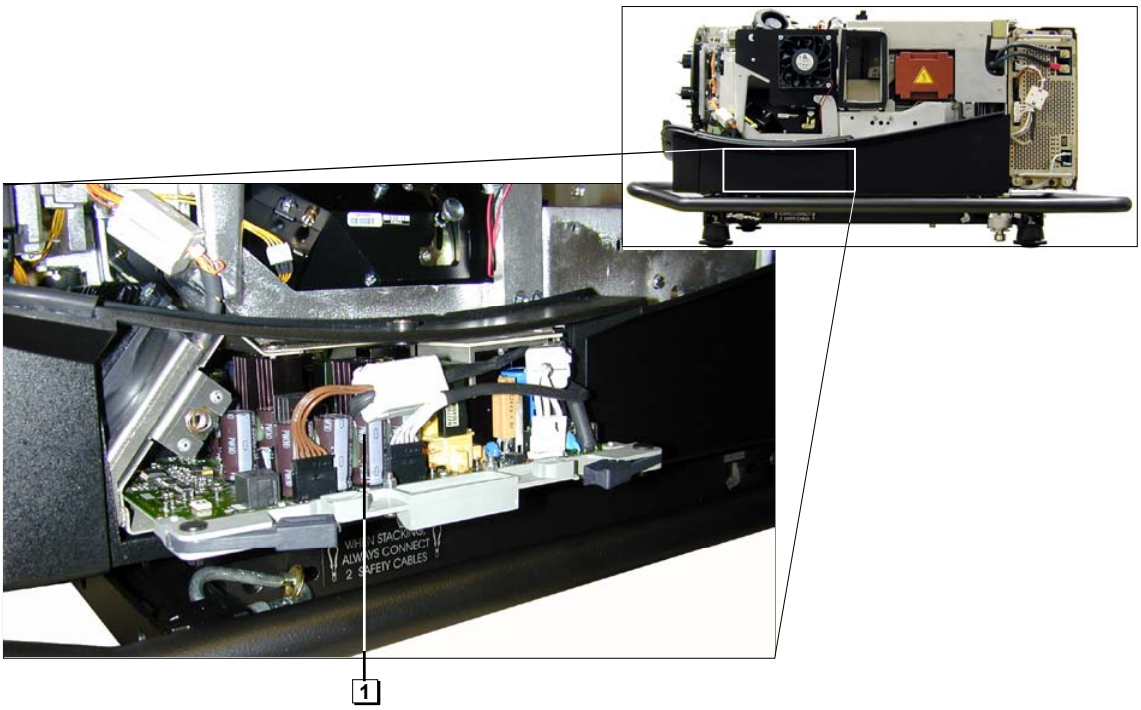


Image 4-14
Switch Mode Power Supply

Picture Ref.	Art. No	Identification	Manual page
1	R764349	Switch Mode Power Supply	

Tilt Switch & Lamp Info

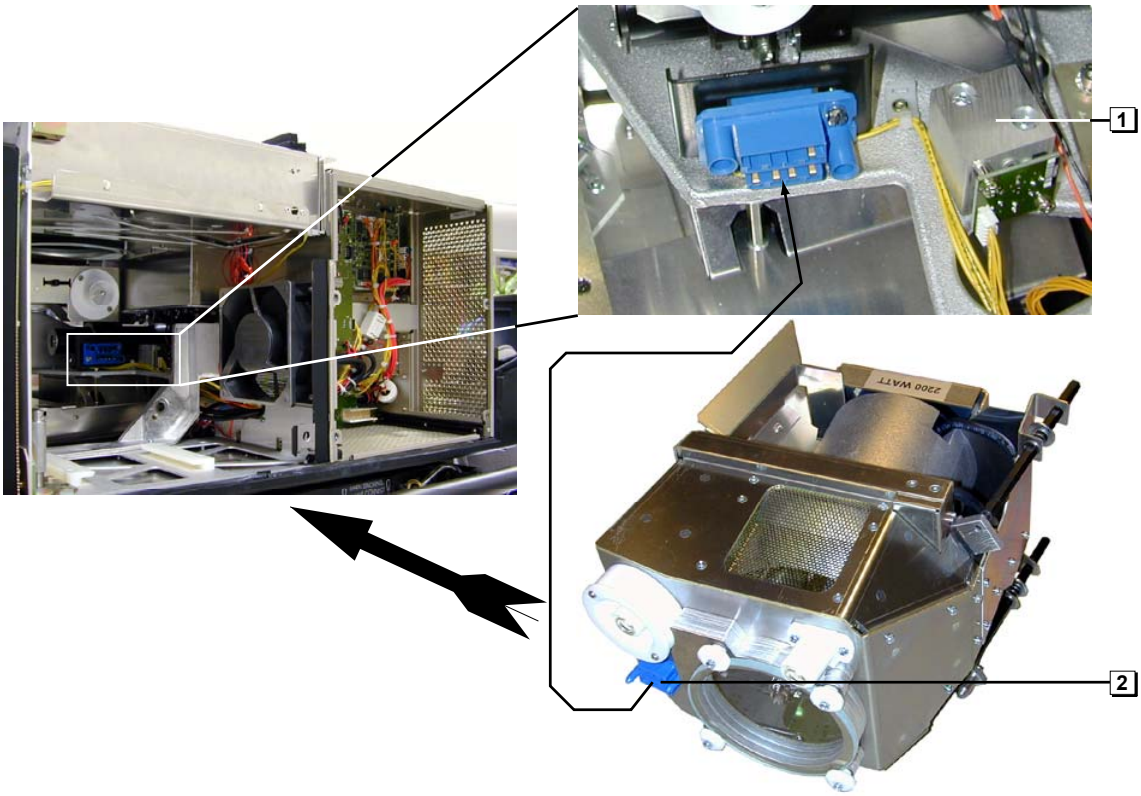


Image 4-15
Tilt switch & Lamp Info

Picture Ref.	Art. No	Identification	Manual page
1	R764240	Tilt Switch	
2	R763295	Lamp Info	

4.4 Projector - Accessories

IR Remote Control (RCU RC5)

Image 4-16
IR Remote Control (RC5)

Projector Ref.	Art. No	Identification	Manual Ref.
1	R763604	IR Remote Control (RC5)	

5. SLM R12+ P - LOCATION OF THE FANS

5.1 Fans - Mounted on Air Outlet

Identification

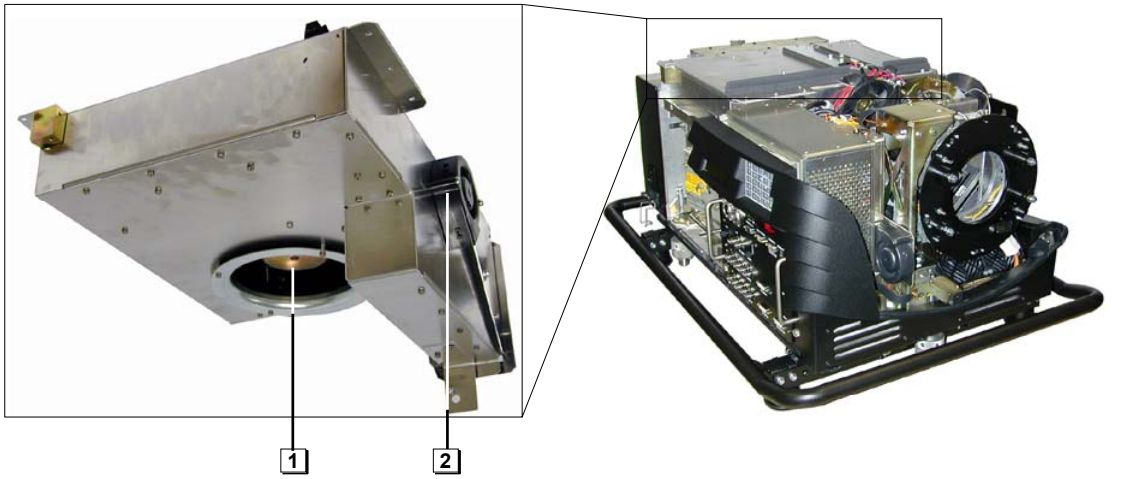


Image 5-1
Fan on Air Outlet

Projector Ref.	Art. No	Identification	Manual Ref.
1	B3245651D	Fan Air Outlet	
2	B3245571D	Fan cooling DMD Green	

5.2 Fans - Mounted on Projector Frame

Identification

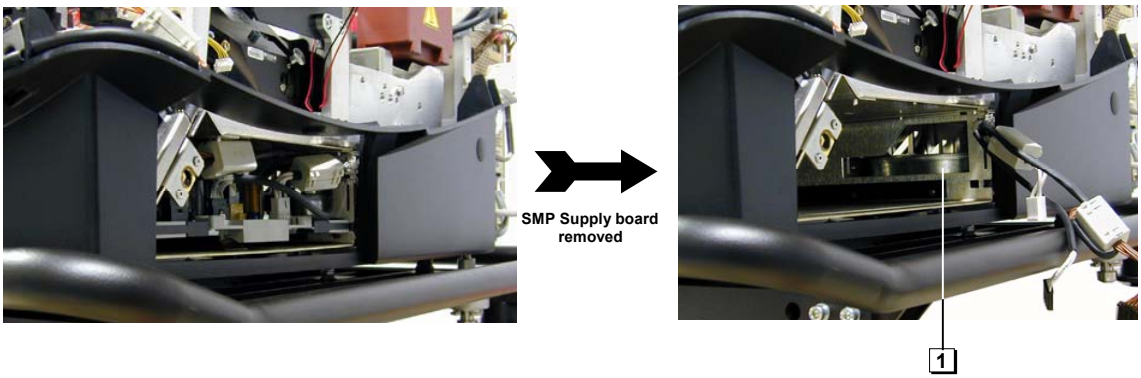


Image 5-2
Lamp Anode Fan

Projector Ref.	Art. No	Identification	Manual Ref.
1	B3245621D	Fan cooling Lamp Anode	

Identification

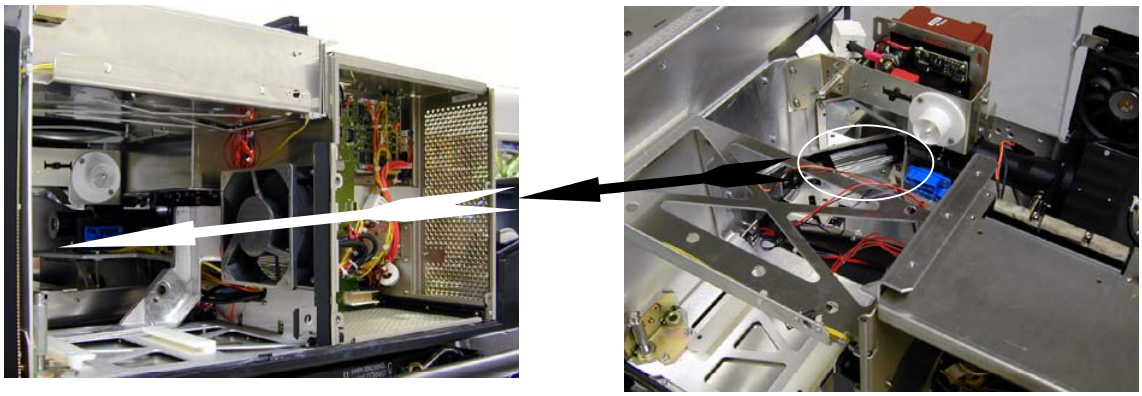


Image 5-3
Cold mirror Fan

Projector Ref.	Art. No	Identification	Manual Ref.
1	B3245911D	Fan cooling Cold mirror	

Identification

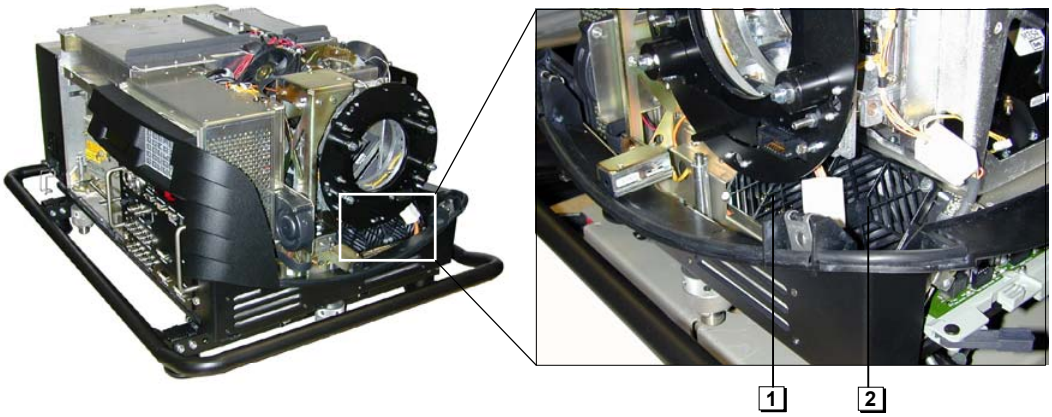


Image 5-4
Fans on front projector

Projector Ref.	Art. No	Identification	Manual Ref.
1	B3245311D	Fan cooling SMPS	
2	B3245311D	Fan cooling SMPS	

5.3 Fans - Mounted on the Electronic Box

Identification

Image 5-5
Fan on Elca Box

Projector Ref.	Art. No	Identification	Manual Ref.
1	B3245963D	Fan cooling PMP & Lamp Cathode	
2	B3245571D	Fan cooling DMD Red	

5.4 Fans - Mounted on Optical Base

Identification

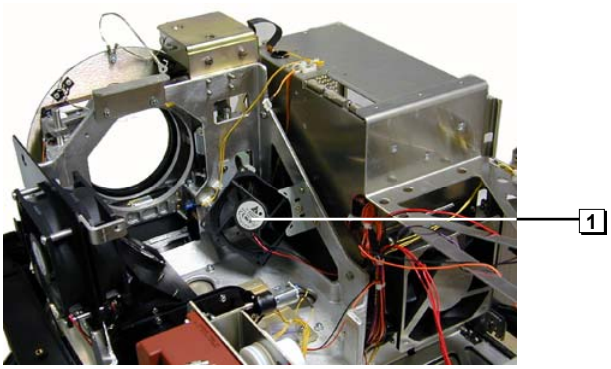


Image 5-6
Fan-Cooling Red & Green DMD

Projector Ref.	Art. No	Identification	Manual Ref.
1	B324646D	Fan cooling Red DMD	

Identification

Image 5-7
Fans-Light Engine outlet

Projector Ref.	Art. No	Identification	Manual Ref.
1	B3246261	Light Engine air exhaust	

5.5 Fans - Mounted on Light Engine

Identification

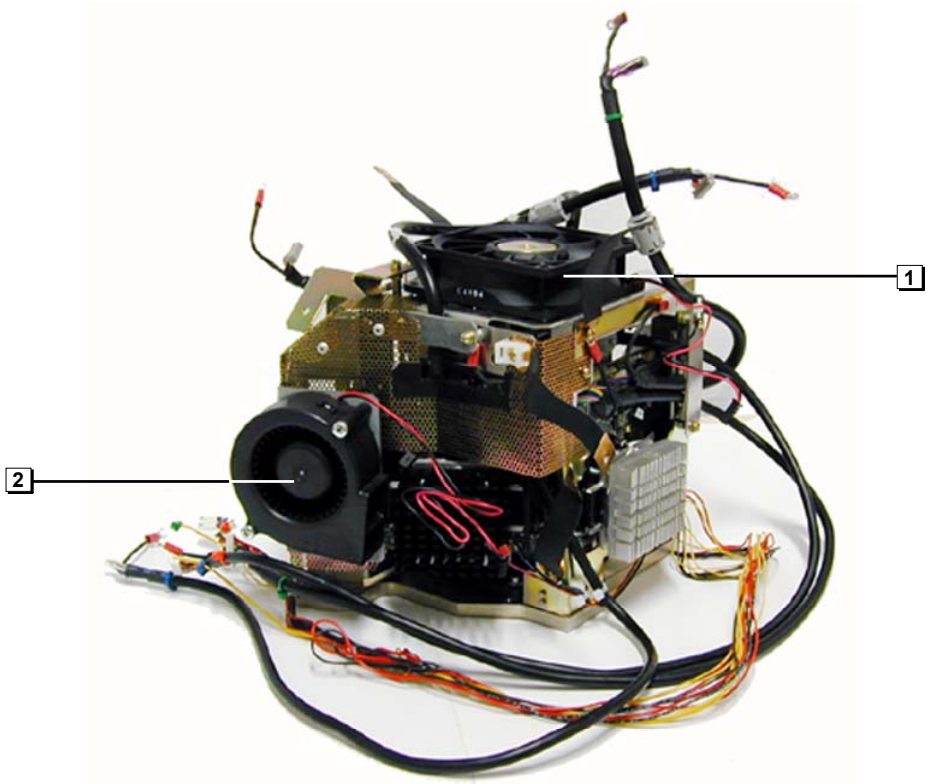


Image 5-8
Fans-Light engine

Projector Ref.	Art. No	Identification	Manual Ref.
1	B3246261D	Fan cooling light engine top (Prism)	
2	B324557D	Fan cooling DMD Blue	

5.6 Fans - Mounted on the Lamp Power Supply

Identification

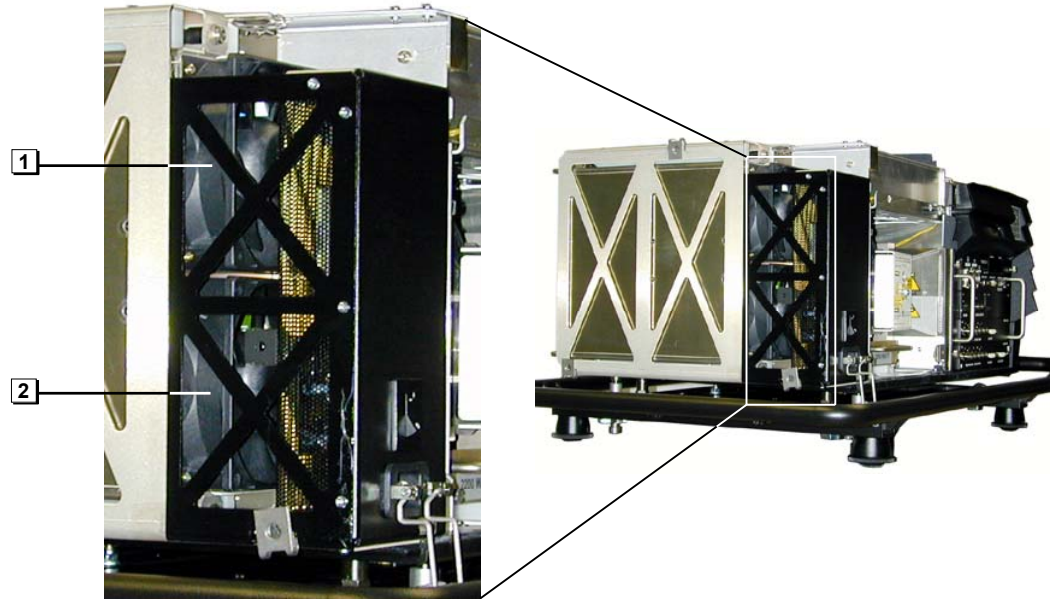


Image 5-9
Fans-LPS mounted

Projector Ref.	Art. No	Identification	Manual Ref.
1	B3245962D	Fan cooling LPS	
2	B3245962D	Fan cooling LPS	

6. INTERCONNECTION DIAGRAM

6.1 Interconnection diagram

Block diagram

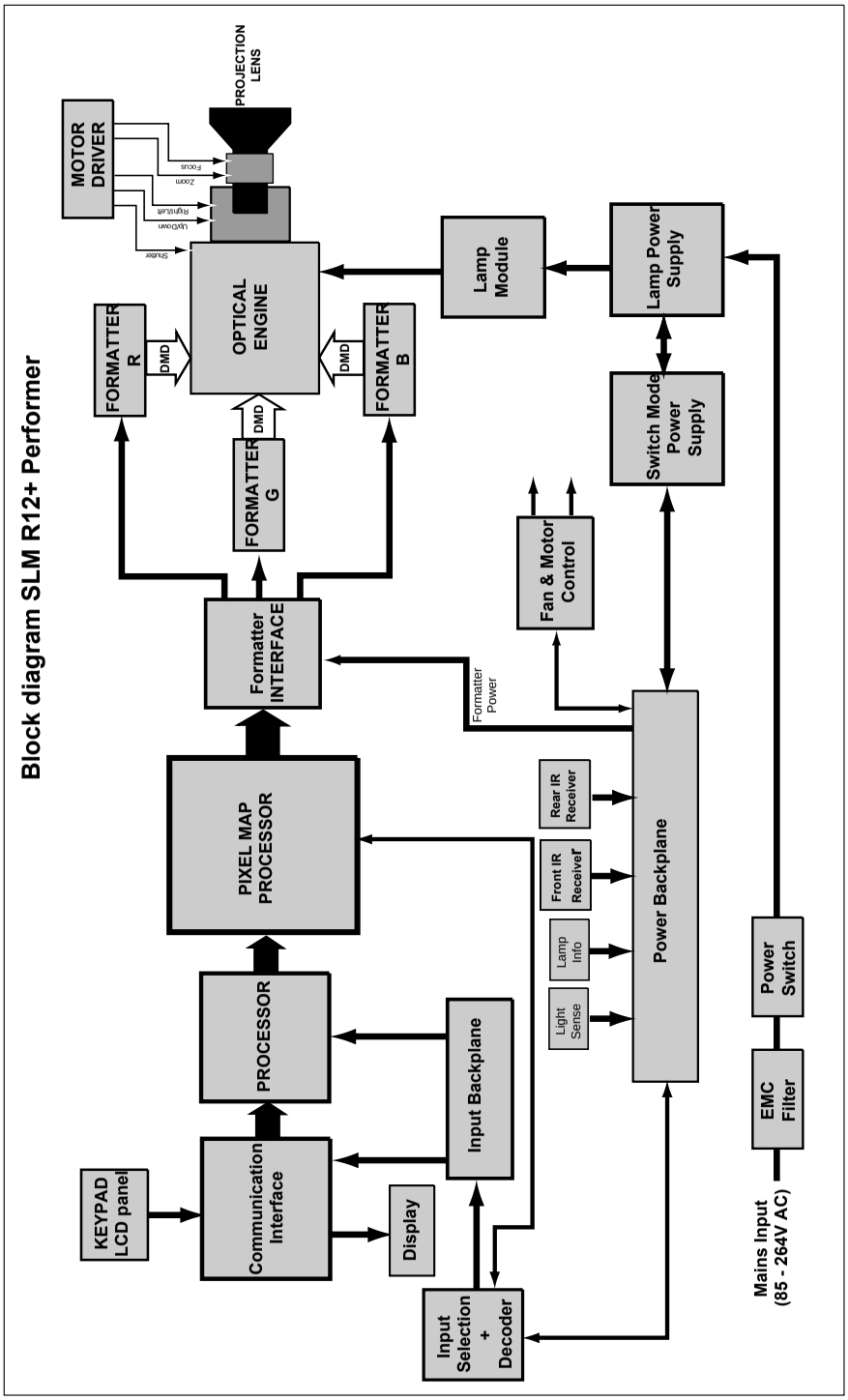


Image 6-1
Block diagram

Interconnection diagram

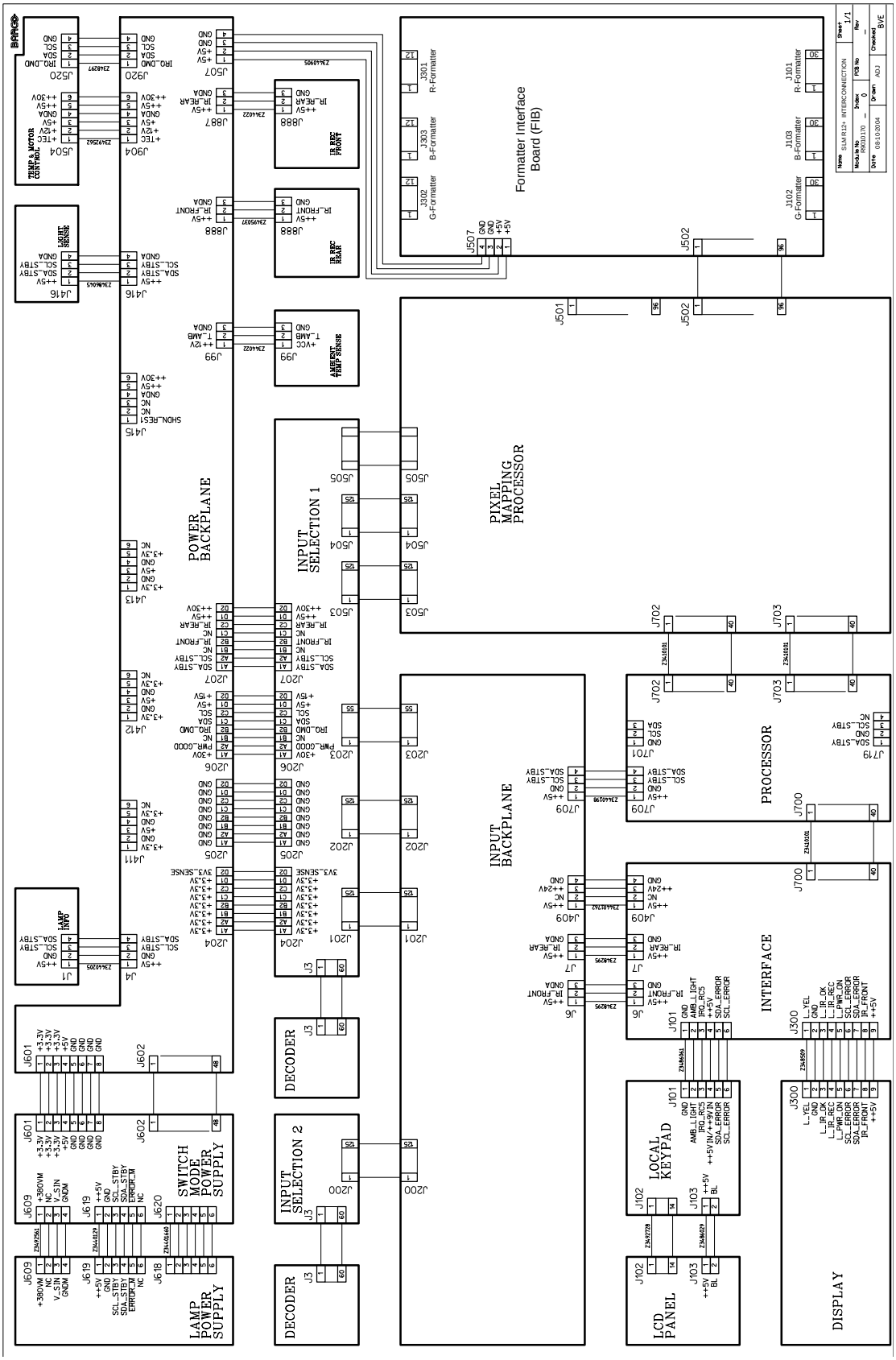


Image 6-2
Interconnection diagram

7. IR TRANSMITTER RC-5 CODED R763569

7.1 General Info

View of the Remote Control

Image 7-1
1 IR Remote Control RC5 coded

View of the RCU Board

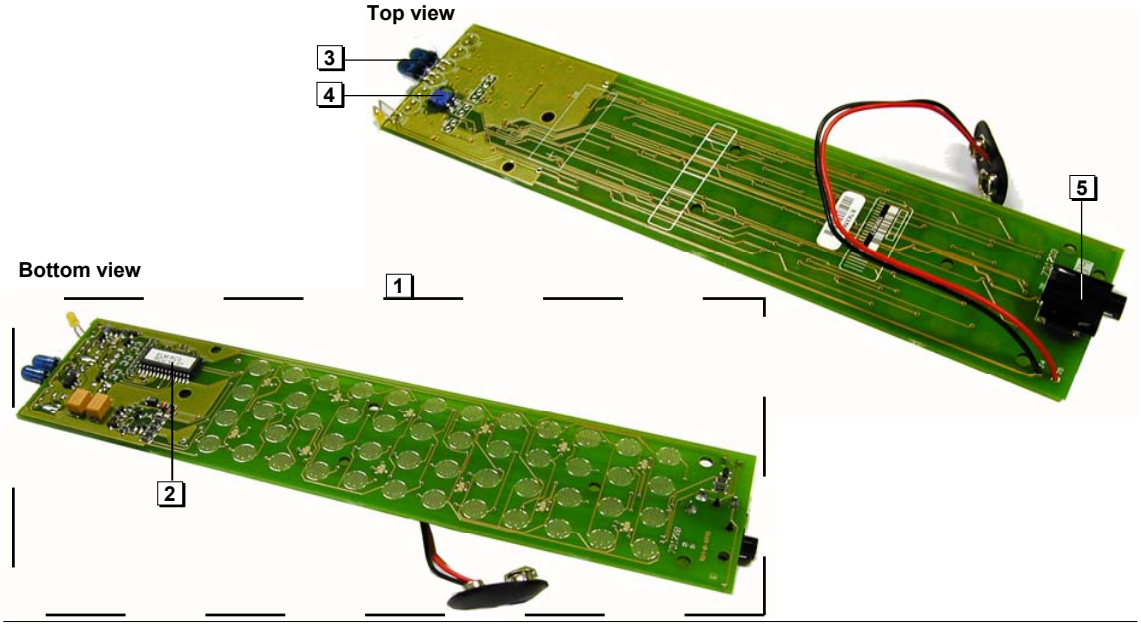


Image 7-2
RCU board

Picture Ref.	Article No	Description
1	**R763569**	RCU module complete
2	**R32875801**	EPROM-Based Micro Controller
3	**R1316666**	D O TSUS5202 T IR
4	**V306895**	XT1 RSN CE 0M864 P 2
5	**B338800**	J PHN FBS D 3,5MON P

7.2 Access to the IR Transmitter Board

Handle as follows:

1. Remove the screw (1) , using a Torx Screwdriver (T10), holding top and bottom housing together.

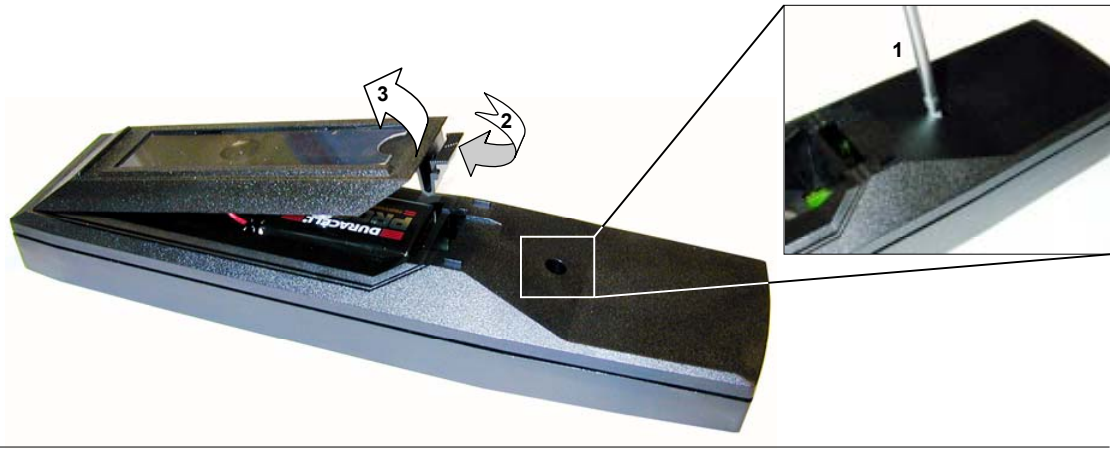


Image 7-3
Access to IR transmitter board

2. Remove the battery cover (2&3) and disconnect the battery.
3. Separate the top from bottom housing as follows:
   Important: The top housing clicks onto the bottom housing onto 4 points on both long sides. To remove the top housing, release the 4 click points (A..D) on one side of the remote control.
   - Insert a flat screwdriver in the groove near to the click point.

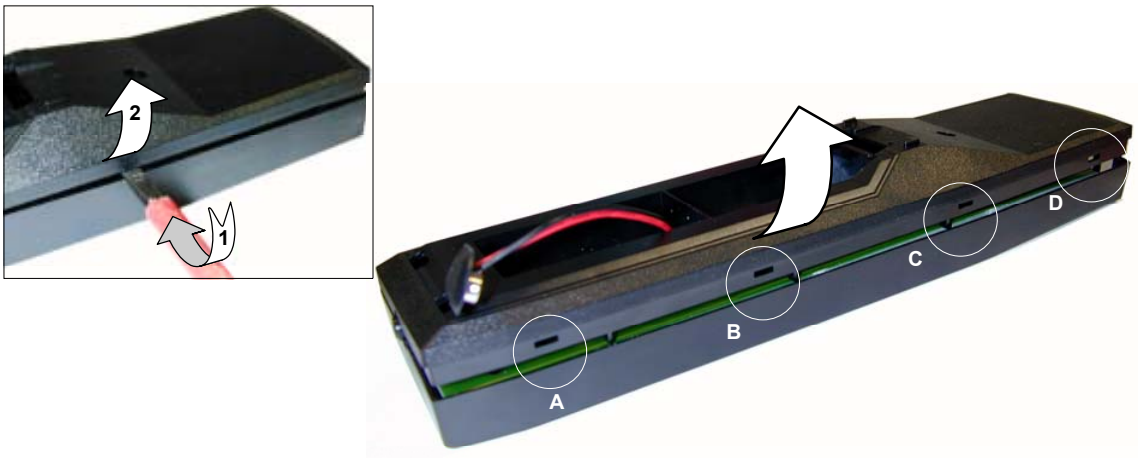


Image 7-4
Access to IR transmitter board

   - Push a little pressure (1) on the screwdriver (to unlock) and lift up (2) the top housing on that specific click point.
   - Repeat the same action on the four click points of the same side.
4. Remove the bottom housing.

7.3 Battery Plug in

Place of the battery on delivery

The battery for the RCU is not yet installed on delivery, to save the battery life time, and is placed in the upper compartment (B) (image 7-5) inside the RCU.

How to plug in!

1. Press the battery cover (A) lock (1) inwards and simultaneously lift up the cover (2) for removal.

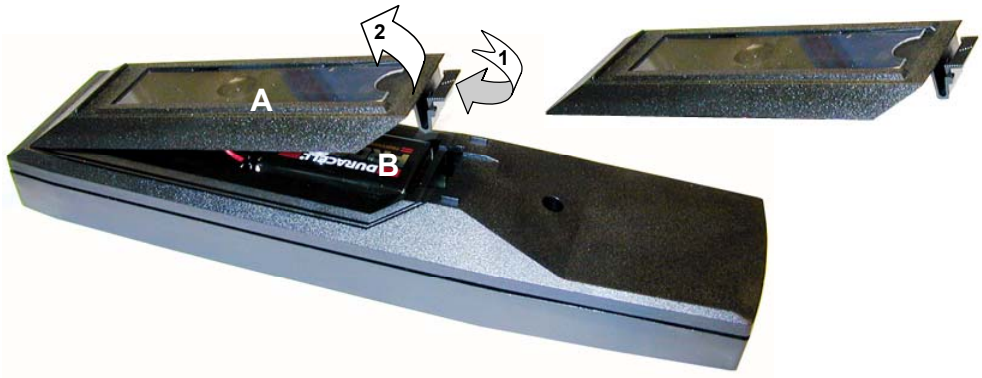


Image 7-5
Battery cover removal

2. Plug in the battery (9 V battery - type E-block or equivalent) onto the battery contact plate (A).

Image 7-6
Battery connection

3. Place the battery into the lower compartment (B) (.image 7-6)
4. Insert the pins of the battery cover (A) into the slots on the bottom of battery back cover and close the cover by pushing downwards (B) until it clicks.

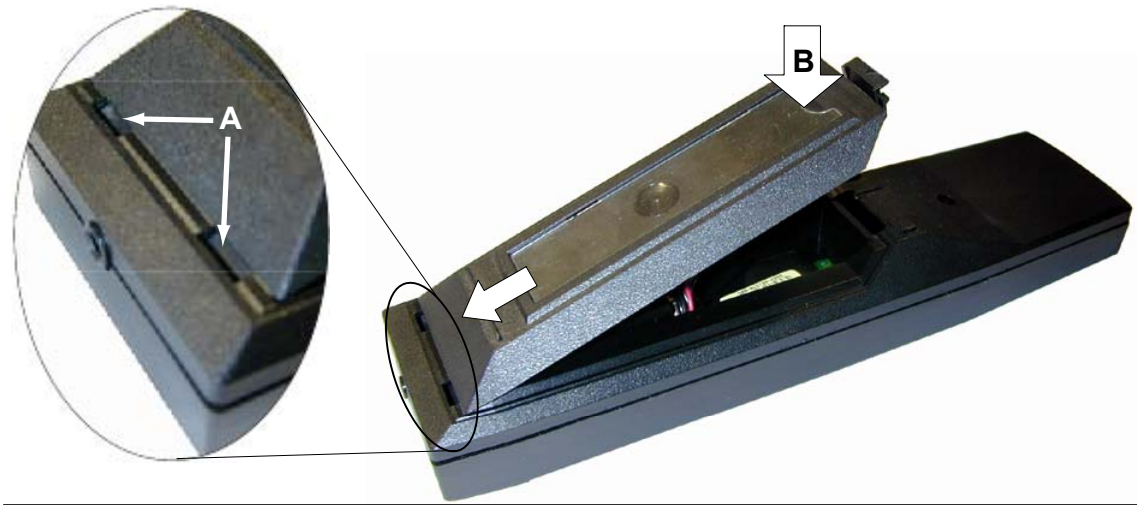
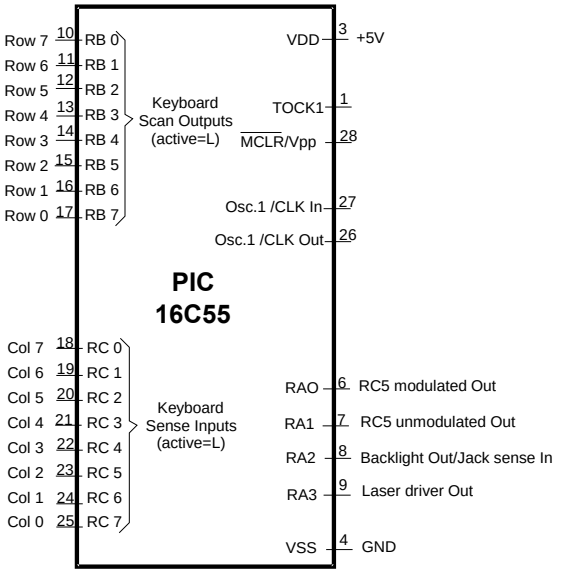


Image 7-7
Battery cover mount

7.4 Technical Info

Pin Assignment Micro Contoller


Row 7 10 RB 0
Row 6 11 RB 1
Row 5 12 RB 2
Row 4 13 RB 3
Row 3 14 RB 4
Row 2 15 RB 5
Row 1 16 RB 6
Row 0 17 RB 7
Keyboard Scan Outputs (active=L)
VDD 3 +5V
TOCK1 1
MCLR/Vpp 28
Osc.1 /CLK In 27
Osc.1 /CLK Out 26
PIC 16C55
Col 7 18 RC 0
Col 6 19 RC 1
Col 5 20 RC 2
Col 4 21 RC 3
Col 3 22 RC 4
Col 2 23 RC 5
Col 1 24 RC 6
Col 0 25 RC 7
Keyboard Sense Inputs (active=L)
RAO 6 RC5 modulated Out
RA1 7 RC5 unmodulated Out
RA2 8 Backlight Out/Jack sense In
RA3 9 Laser driver Out
VSS 4 GND

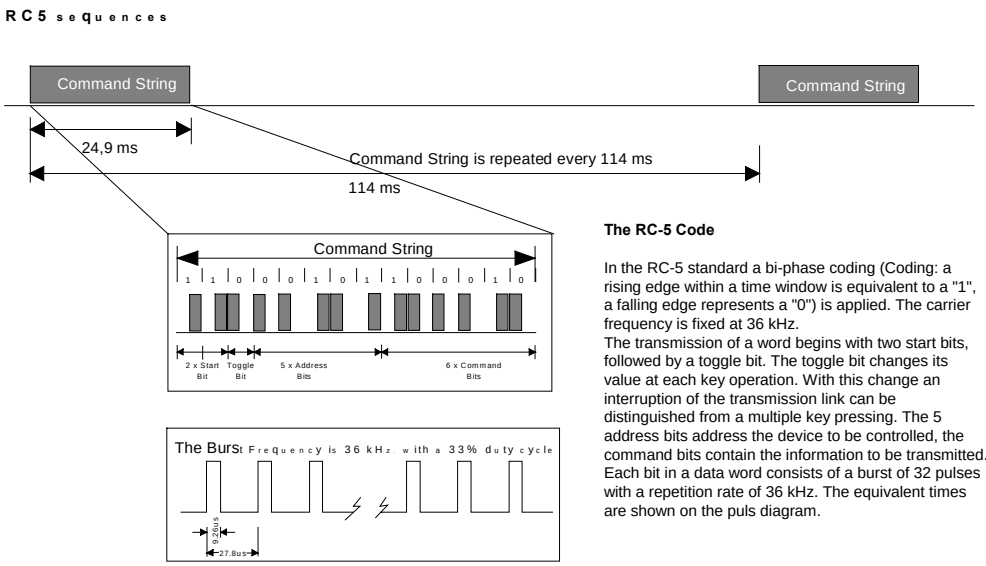
Pin functions:

VDD : Power Supply
VSS : Ground connection
Oscillator (osc1, Osc2): Use of a 864 kHz Ceramic resonator with 2 load capacitors of 82pF.
MCLR Reset Input : to be activated in 2 cases:
- Power On: all memory locations are initialised.
- Awake from sleep: option jumpers are scanned and memorised, keyboard matrix is scanned, key entries are processed, and the device goes back to sleep.

RA0/RA1: RC5 modulated/unmodulated driver outputs: active=H
Pulse sequence: RC5; with/without 36 kHz Carrier Frequency respectively.
RA2 : Backlight Sense Input/Driver Output: active=high
Turns on for 5sec when a key is hit. This period is retriggered when another key is hit. During this period, the PIC doesn't enter the sleep mode.
If this pin is tied high (through a resistor) before it is driven high internally, the program assumes that the Remote Control is connected to a projector by means of the jack connector. In this case, the modulated RC5 driver output is disabled internally.
RA3 : Laser Driver Output active=high
RB0..RB7 : Keyboard Scan Outputs active=low
RC0..RC7 : Keyboard Sense Inputs (External pull up resistors) active=low

Image 7-8
Pin assignment micro controller

RC5 Sequences

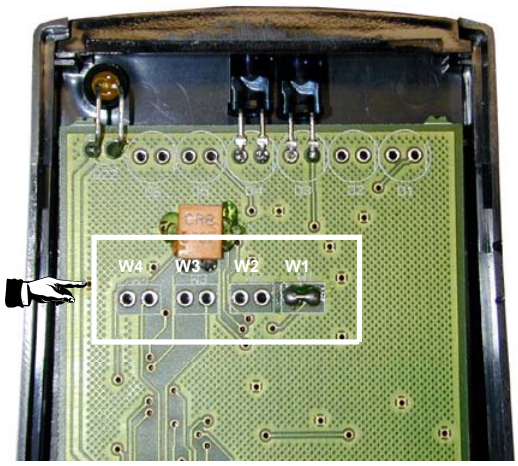

RC5 sequences
Command String
Command String
24,9 ms
Command String is repeated every 114 ms
114 ms
Command String
1 1 0 0 0 1 0 1 1 0 0 0 1 0
2 x Start Bit
Toggle Bit
5 x Address Bits
6 x Command Bits
The Burst Frequency is 36 kHz with a 33% duty cycle
~27.8us

The RC-5 Code

In the RC-5 standard a bi-phase coding (Coding: a rising edge within a time window is equivalent to a "1", a falling edge represents a "0") is applied. The carrier frequency is fixed at 36 kHz.
The transmission of a word begins with two start bits, followed by a toggle bit. The toggle bit changes its value at each key operation. With this change an interruption of the transmission link can be distinguished from a multiple key pressing. The 5 address bits address the device to be controlled, the command bits contain the information to be transmitted. Each bit in a data word consists of a burst of 32 pulses with a repetition rate of 36 kHz. The equivalent times are shown on the puls diagram.

Image 7-9
RC5 sequences

Enhancements



Enhancements:

Jumper W1 'Address Mode' Installed?

- Yes: command send with free address
- No: command send with fixed address

Jumper W2 'Address Entry' Installed?

- Yes: entering address with 2 digits (0..31)
- No: entering address with 1 digit (0..9)

Jumper W3 'Extend' Installed?

- Yes: extended
- No: Standard RC5 protocol

Jumper W4 : further expansion

Image 7-10
Remote control enhancements

7.5 Technical Description

Introduction

The Infra Red Remote control is built around an EPROM-Based 8-Bit CMOS Microcontroller with hardware selectable enhancements.

Operation

During the idle time of the RCU, the IC PIC is in the sleep mode and all scan outputs are low. Any key action will discharge the RESET timing capacitor C3 through the involved sense input pull up resistor (R1..R8). When the C3 voltage drops to 0.15VDD, the PIC resets and puts the scan outputs in the Hi_Z state. The capacitor C3 recharges through the resistor R9 and when the 0.15VDD is reached, the PIC starts running. Since this is a reset from sleep, a 'warm reset' procedure is started, which reads "IN" the option jumpers. Pin RB7 is put high to bias the pull up resistor R12. One after another, pins RB0...RB6 generate 1, 2, 4, 8,...64 pulses respectively, which are counted by the PIC. The totalled counts reveal which option jumpers are installed. After that, a delay loop is initiated to obtain a total key debounce of 20 ms. Next, the keyboard matrix is scanned: one after another the rows are forced to low through the scan pins RB0..RB7, and each time, the column pattern is read through the sense inputs RC0..RC7. The whole matrix is always scanned to detect simultaneously key activations, in which case the scan results are ignored. The scan pulses only last 20 oscillator periods, short enough to have no influence on the reset pin voltage.

Depending on which key was pressed, the following actions can be taken:

1. Address key (S43): The 'ADDR' command is transmitted along with the 'always listen' address value (address '0'). A 5 seconds countdown starts, during which 1 or 2 numeric key entries are expected. Each numeric key entry is followed by a 260 ms holdoff and restarts the countdown, but now for 2 seconds. If the initial time window elapses without a numeric key entry, or if an invalid address (e.g. >31) is entered, the RCU address is reset to the 'always listen' value.

2. Laser key (S41): If the option, pin RB6, is activated (RCU type is executive) the RA3 pin is switched high and no code is transmitted.

3. Other keys: The corresponding command is transmitted along with the address last entered. The command bits are NOT related to the matrix co-ordinates: the key number, which is =row*8+column, is used to select the appropriate command from a look up table. (e.g. Button S41 pressed - Key number=2(row)x8+7(colomn)=23)

After transmitting, the keyboard is scanned once more to detect if a key is still pressed. This keeps the repetition rate controllable at exactly 115 ms, because the reset timing is offside now.

Power supply

The IC1 needs to run from the +3V Nominal type (2 x 1.5V cells).

IR LED drive

The transistors Q1 and Q2 drive the IR LED's in a constant current figuration. An emitter-follower Q5, which is following the pulse output of IC1, provides the drive current for the bases of the 2 transistors. The base signal of Q5 is stabilized in amplitude. The capacitor C5 acts as a reservoir for supplying the high current pulses (up to 400 mA in total) that could not be drawn from the 3V battery on its own, due to the internal resistance.

Backlight LED Drive

The transistor Q8 drives the 12 LED's via their ballast resistors R30..R41. The On/Off status is imposed through R22 by IC1, output RA2, which handles the switch-on criteria. When the Jack cable connection is installed, the transistor Q8 is driven by the saturated transistor Q10 through R25, causing the backlight to be lit continuously.

Indicator LED driving

The transistor Q6 drives the LED D22 via the resistor R28. The latter needs to have a rather small value because the driving pulses are very short. The transistor Q6 is connected to the unmodulated RC5 drive output, pin RA1 of IC1, and drives the LED D5 via the resistor R13.

Jack cable connection

The IC1 also senses the backlight driving pin RA2 whether it is high already before it decides to switch on the backlight; if this is the case, the address is reset to 0 and the modulated IR Output RA0 is blocked.

3.5mm Jack cable connection

The Zenerdiode Z1 and the diode D8 provide the necessary voltage drop from 9V to 3V (Projector supply voltage for the cable connected Remote Control is 9V). The Zenerdiode Z3 limits this internal 3V to 5V maximum. The voltage drop across the zenerdiode Z1 drives the transistor Q8 through the transistors Q11/Q10. The RC5 in formation is injected into the cable as current pulses driven by the transistor Q9. The resistor R20 determines the amplitude of these current pulses that are drawn from the 9V, supply voltage from the projector, where they are detected by a series resistor and further processed. The diode D8 takes care that the transistor doesn't discharge the decoupling capacitors C4 and C5.

8. LOCAL KEYPAD & LCD DISPLAY

8.1 General Info

View of the local keypad & LCD display

Image 8-1
Front view Local Keypad & LCD display

View of the modules

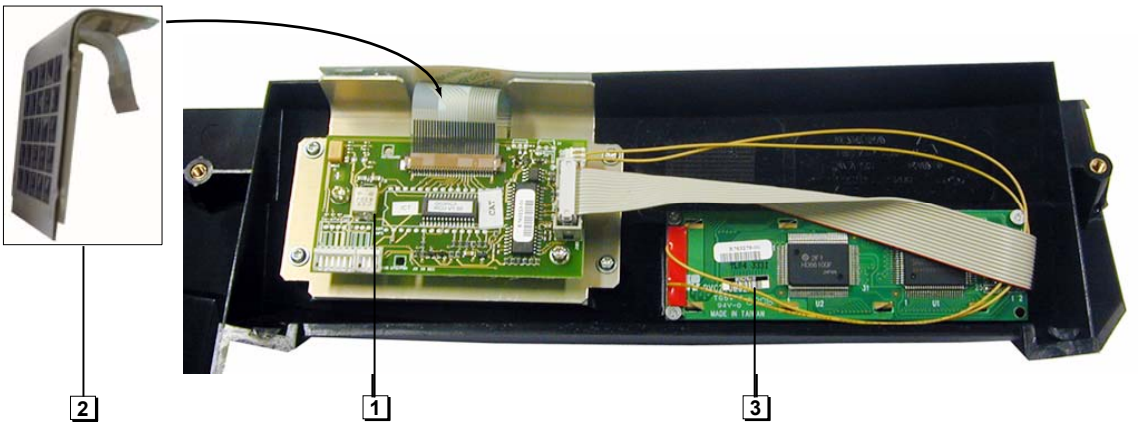


Image 8-2

Picture Ref.	Art. No	Identification
1	R763223	Control Switch board
2	R722864	key pad foil
3	R763279	LCD Display

8.2 Module replacement

Removal LCD Display

1. Disconnect the flat cable plug (1) and wired plug (2) from control switch module.

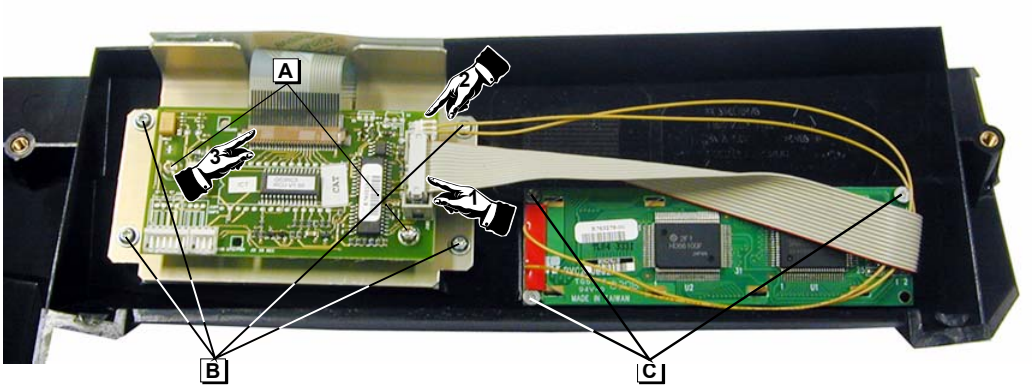


Image 8-3
Board removal

2. Remove the 3 screws (C) holding the board onto the front end.
3. Replace the LCD display module.

Removal Control Switch module

1. Disconnect the flat cable plug (1) and wired plug (2) from control switch module (image 8-3).
2. Release the flat cable locks on both sides of the flat cable connector (3) and remove the key pad flat cable out of connector.
3. Remove the 2 screws (A) holding control switch board onto key pad metal support.
4. Replace the control switch module.

Removal Key pad foil

1. First, remove the control switch module (See preceding procedure).
2. Remove the 4 screws (B) holding key pad metal support onto front end (image 8-3).
3. Replace the key pad foil.

8.3 Technical Description

Introduction

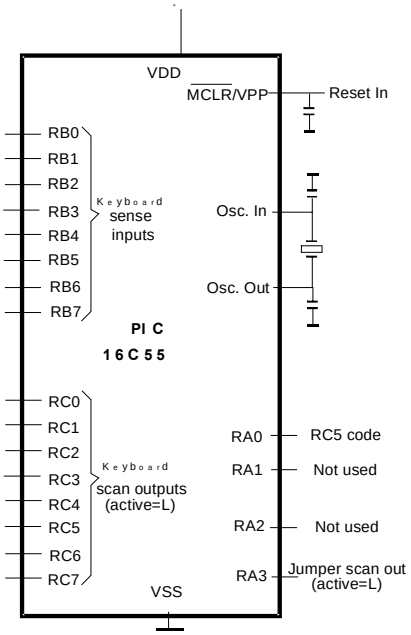
The local control panel is built around a PIC16C55, an EPROM-Based 8-Bit CMOS Microcontroller with hardware selectable enhancements. The difference between I1 and I3 is that the first is a classic through component and the second is a SMD PIC processor version.

The local keypad is the integrated control device of the projector.

Depending on the key that is pressed, an RC5 code is generated. This code is sent to the CPU-board, which converts the code to projector commands.

A character based LCD display (24 characters by 2 lines) can be connected to the unit. This LCD is used for displaying menu's and error messages. The CPU-board can control the display through an I²C I/O expander.

PIC16C55 Pin functions:



Pin functions:

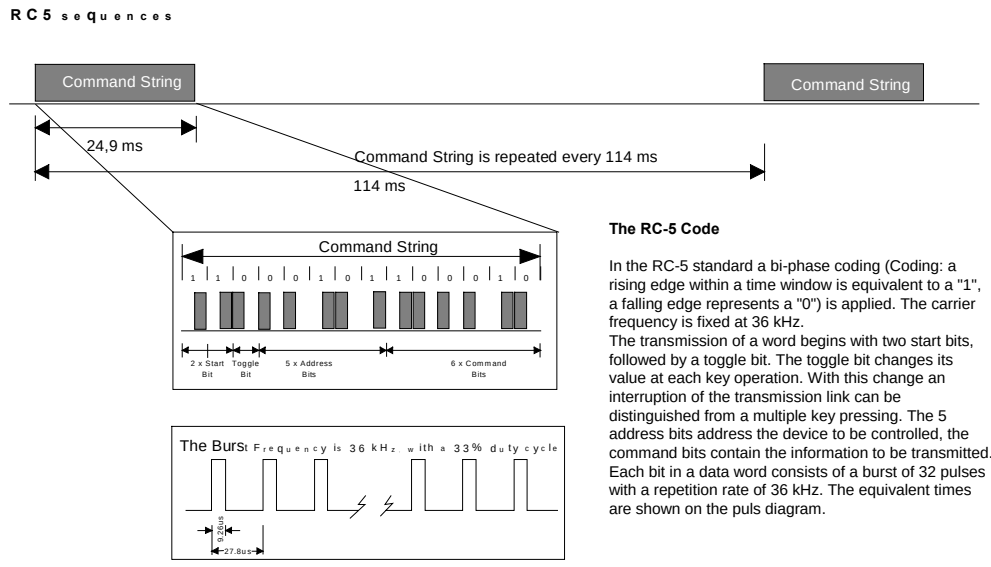
VDD: Power Supply
Vss: Ground connection
Oscillator: Use of a 400kHz Ceramic resonator with 2 load capacitors of 82pF.
MCLR Reset Input : to be activated in 2 cases:
- Power On: all memory locations are initialised.
- Awake from sleep: keyboard matrix is scanned, key entries are processed, and the device goes back to sleep.

RA0: Output to Controller : active=H

RB0..RB7: Keyboard Sense Inputs
RC0..RC7: Keyboard Scan Outputs active=low

Image 8-4
Pic16C55 pin fuctions

RC5 Sequences Extended


RC5 sequences
Command String
Command String
24,9 ms
Command String is repeated every 114 ms
114 ms
Command String
1 1 0 0 0 1 0 1 1 0 0 0 1 0
2 x Start Bit
Toggle Bit
5 x Address Bits
6 x Command Bits
The Burst Frequency is 36 kHz with a 33% duty cycle
~27.8us

The RC-5 Code

In the RC-5 standard a bi-phase coding (Coding: a rising edge within a time window is equivalent to a "1", a falling edge represents a "0") is applied. The carrier frequency is fixed at 36 kHz.
The transmission of a word begins with two start bits, followed by a toggle bit. The toggle bit changes its value at each key operation. With this change an interruption of the transmission link can be distinguished from a multiple key pressing. The 5 address bits address the device to be controlled, the command bits contain the information to be transmitted. Each bit in a data word consists of a burst of 32 pulses with a repetition rate of 36 kHz. The equivalent times are shown on the puls diagram.

Image 8-5
RC5 sequences

During the idle time of the local control panel, the IC PIC is in the sleep mode and all scan outputs are low.

Any key action will discharge the RESET timing capacitor C1 through the involved sense input pull up resistor (R1..R8). When the C1 voltage drops to 0.15VDD, the PIC resets and puts the scan outputs in the Hi_Z state. The capacitor C1 recharges through the resistor R9 and when the 0.15VDD is reached, the PIC starts running.

Since this is a reset from sleep, a 'warm reset' procedure is started, the scan pin is put to low momentarily, during which time the 8 sense inputs are read and stored in the memory. After that, key debounce is done by a 20ms delay loop.

Next, the keyboard matrix is scanned: one after another the columns are forced to low through the scan pins RC0..RC7, and each time, the bit pattern of the column is read through the sense inputs RB0..RB7.

Q1 is the output buffer and ensures the output is inverted on its route to the output connector J1, D1 is a protection diode for the output logic, and D2 protects I2 from inverse voltage.

The whole matrix is always scanned to detect simultaneously pressed keys, in which case the scan results are ignored. The scan pulses only last 20 oscillator periods, short enough to have no influence on the reset pin voltage.

Depending on which key was pressed, the following actions can be taken:

1. Address key: The 'ADDR' command is activated along with the 'always listen' address value (address '10'). A 5 seconds countdown starts, during which 1 or 2 numeric key entries are expected. Each numeric key entry is followed by a 260 ms hold off and restarts the countdown, but now for 2 seconds. If the initial time window elapses without a numeric key entry, or if an invalid address (e.g. >16) is entered, the local control panel address is reset to the 'always listen' value.

2. Other keys: The corresponding command is activated along with the address last entered. The command bits are related to the matrix coordinates as follows:

Matrix	**command** = (<row> **x 8**) + <column>
e.g. 'PAUSE' button pressed	**command** = (1 **x 8**) + 7 = 15

After activating, the keyboard is scanned once more to detect if a key is still pressed. This keeps the repetition rate controllable at exactly 130ms, because the reset timing is offside now.

This unit was designed for the ELM series which has a character 24x2 character LCD display.

The functionality of all previous local controls are combined in this unit, therefore the unit can be used in all non-CRT projectors.

The display can be controlled by the CPU-board through an I²C I/O expander (I20) and a latch (I21). I²C adresss of the I/O expander is 0x7F. The display needs an 8 bit databus, a clock signal and a register select (selects if incoming data is command or data). The output of the I/O expander provides the clock and register select and the upper nibble of the databus (D4..D7), the latch control and a control signal for the backlight of the display. The latch is used to create an 8-bit databus.

The contrast voltage of the display must be independent of the supply voltage, hence a voltage reference (Z101) is needed.

8.4 Status Conditions & Fault Analysis

8.4.1 Error List on LCD and INFO display

Error List

The first column of this table represents the two characters displayed on the information display and the second column the fault description displayed in the LCD display.

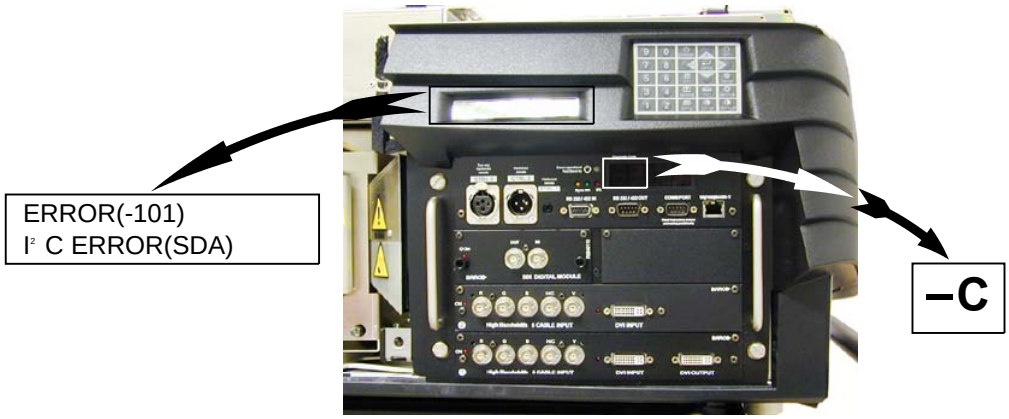


Image 8-6
Display fault analysis

Info Display	LCD Display	Error Description
- C	ERROR(-101) I²C ERROR(SCL)	The I²C SCL line doesn't react (held down), so no I²C communication is possible.
- d	ERROR(-102) I²C ERROR(SDA)	The I²C SDA line doesn't react (held down), so no I²C communication is possible.
- L	ERROR(-1000) WRONG LAMP PARAMETER(S)	No I²C communication with the lamp module EEPROM or Lamp parameter "article number" unknown or corrupt.
- L	ERROR(-1001) WRONG LAMP PARAMETER(S)	Lamp parameter "maximum current" corrupt or not within range.

Info Display	LCD Display	Error Description
- L	ERROR(-1002) WRONG LAMP PARAMETER(S)	Lamp parameter "maximum power" corrupt or not within range.
- L	ERROR(-1003) WRONG LAMP PARAMETER(S)	Lamp parameter "minimum power" corrupt or not within range.
- L	ERROR(-1004) WRONG LAMP PARAMETER(S)	Lamp parameter "minimum power" greater than lamp parameter "maximum power".
- L	ERROR(-1005) WRONG LAMP PARAMETER(S)	Lamp parameter "power" corrupt or not within range.
- L	ERROR(-1006) WRONG LAMP PARAMETER(S)	Lamp parameter "nominal power" corrupt or not within range.
- L	ERROR(-1007) WRONG LAMP PARAMETER(S)	Lamp parameter "nominal power" less than lamp parameter "minimum power".
- L	ERROR(-1008) WRONG LAMP PARAMETER(S)	Lamp parameter "nominal power" greater than lamp parameter "maximum power".
- L	ERROR(-1009) WRONG LAMP PARAMETER(S)	Lamp parameter "maximum run time" corrupt or not within range.
- L	ERROR(-1010) WRONG LAMP PARAMETER(S)	Lamp parameter "run time" corrupt or not within range.
- L	ERROR(-1011) WRONG LAMP PARAMETER(S)	Lamp parameter "run time message" corrupt .
- L	ERROR(-1012) WRONG LAMP PARAMETER(S)	Lamp parameter "run time warning" corrupt .
- L	ERROR(-1013) WRONG LAMP PARAMETER(S)	Lamp parameter "run time auto-shutdown" corrupt.
- L	ERROR(-1014) WRONG LAMP PARAMETER(S)	Lamp parameter "start-up power" corrupt or not within range.
- L	ERROR(-1015) WRONG LAMP PARAMETER(S)	Lamp parameter "start-up power" less than lamp parameter "minimum power".
- L	ERROR(-1016) WRONG LAMP PARAMETER(S)	Lamp parameter "start-up power" greater than lamp parameter "maximum power".
- L	ERROR(-1017) WRONG LAMP PARAMETER(S)	Lamp parameter "run time" not within range
- L	ERROR(-1100) LAMP OVERTEMP	The temperature of the lamp is too high.
- L	ERROR(-1101) LAMP SENSOR NOT CONNECTED	The lamp sensor is not connected.
- L	ERROR(-1102) LAMP NOT INSERTED WELL	The lamp is not inserted well.
- L	ERROR(-2000) NO LPS DETECTED	No I^2C communication with the LPS modules.

Info Display	LCD Display	Error Description
- L	ERROR(-2001) MAINS VOLTAGE TOO LOW	Mains voltage lower than minimum specified mains voltage.
- L	ERROR(-2002) LAMP START FAILED	Unable to start the lamp.
- L	ERROR(-2003) MAINS VOLTAGE TOO HIGH	Mains voltage higher than maximum specified mains voltage.
- L	ERROR(-2004) LAMP GONE OUT	Lamp shut down, unknown error
- L	ERROR(-2040) MAINS ERROR FROM LPS	There is no mains supply from LPS to SMPS
- L	ERROR(-2101) LAMP POWER SUPPLY	LPS with I²C slave address 0x20: Fuse F100 is blown.
- L	ERROR(-2104) LAMP POWER SUPPLY	LPS with I²C slave address 0x20: Mains voltage too low; must be >180Vrms.
- L	ERROR(-2124) LAMP POWER SUPPLY	LPS with I²C slave address 0x20: Error in LPS power circuits.
- L	ERROR(-21xx) LAMP POWER SUPPLY	LPS with I²C slave address 0x20: Unknown LPS error
- L	ERROR(-2201) START PC NOT OK	LPS with I²C slave address 0x20: Start-up of the PFC module failed.
- L	ERROR(-2202) START LPS NOT OK	LPS with I²C slave address 0x20: Start-up of the LPS module failed.
- L	ERROR(-2203) START BOOST NOT OK	LPS with I²C slave address 0x20: Start-up of the BOOST module failed.
- L	ERROR(-2206) LAMP IGNITION FAILED	LPS with I²C slave address 0x20: Ignition of the lamp failed.
- L	ERROR(-2207) LAMP VOLTAGE OUT RANGE	LPS with I²C slave address 0x20: The voltage at the lamp is too high.
- L	ERROR(-2208) LAMP POWER OUT RANGE	LPS with I²C slave address 0x20: The power at the lamp is too high.
- L	ERROR(-2209) OVERTEMP IN LPS	LPS with I²C slave address 0x20: Temperature in LPS is too high.
- L	ERROR(-2210) HTSNK OVERTEMP LPS	LPS with I²C slave address 0x20: Heatsink temperature in LPS is too high.
- L	ERROR(-2211) AMBIENT OVERTEMP LPS	LPS with I²C slave address 0x20: Ambient Temperature in LPS is too high.
- L	ERROR(-2212) FAN ERROR LPS	LPS with I²C slave address 0x20: Fan error.
- L	ERROR(-2401) LAMP POWER SUPPLY	LPS with I²C slave address 0x22: Fuse F100 has blown up.

Info Display	LCD Display	Error Description
- L	ERROR(-2404) LAMP POWER SUPPLY	LPS with I²C slave address 0x22: Mains voltage too low; must be >180Vrms.
- L	ERROR(-2424) LAMP POWER SUPPLY	LPS with I²C slave address 0x22: Error in LPS power circuits.
- L	ERROR(-24xx) LAMP POWER SUPPLY	LPS with I²C slave address 0x22: Unknown LPS error.
- L	ERROR(-2501) START PFC NOT OK	LPS with I²C slave address 0x22: Start-up of the PFC module failed.
- L	ERROR(-2502) START LPS NOT OK	LPS with I²C slave address 0x22: Start-up of the LPS module failed.
- L	ERROR(-2503) START BOOST NOT OK	LPS with I²C slave address 0x22: Start-up of the BOOST module failed.
- L	ERROR(-2506) LAMP IGNITION FAILED	LPS with I²C slave address 0x22: Ignition of the lamp failed.
- L	ERROR(-2507) LAMP VOLTAGE OUT RANGE	LPS with I²C slave address 0x22: The voltage at the lamp is too high.
- L	ERROR(-2508) LAMP POWER OUT RANGE	LPS with I²C slave address 0x22: The power at the lamp is too high.
- L	ERROR(-2509) OVERTEMP IN LPS	LPS with I²C slave address 0x22: Temperature in LPS is too high.
- L	ERROR(-2510) HTSNK OVERTEMP LPS	LPS with I²C slave address 0x22: Heatsink temperature in LPS is too high.
- L	ERROR(-2511) AMBIENT OVERTEMP LPS	LPS with I²C slave address 0x22: Ambient temperature in LPS is too high.
- L	ERROR(-2512) FAN ERROR LPS	LPS with I²C slave address 0x22: Fan error.
- L	ERROR(-2701) LAMP POWER SUPPLY	LPS with I²C slave address 0x28: Fuse F100 has blown up.
- L	ERROR(-2704) LAMP POWER SUPPLY	LPS with I²C slave address 0x28: Mains voltage too low; must be >180Vrms.
- L	ERROR(-2723) LAMP POWER SUPPLY	LPS with I²C slave address 0x28: Error in LPS low voltage circuits.
- L	ERROR(-2724) LAMP POWER SUPPLY	LPS with I²C slave address 0x28: Error in LPS power circuits.
- L	ERROR(-2725) LAMP POWER SUPPLY	LPS with I²C slave address 0x28: Lamp has gone out and LPS still running.
- L	ERROR(-2726) LAMP POWER SUPPLY	LPS with I²C slave address 0x28: Lamp output short-circuited.
- L	ERROR(-2727) LAMP POWER SUPPLY	LPS with I²C slave address 0x28: Output power out of range.

Info Display	LCD Display	Error Description
- L	ERROR(-2740) LAMP POWER SUPPLY	LPS with I²C slave address 0x28: "Error mains" signal from SMPS module has shut down the LPS module.
- L	ERROR(-2750) LAMP POWER SUPPLY	LPS with I²C slave address 0x28: Over-temperature on heatsink mains rectifier.
- L	ERROR(-2751) LAMP POWER SUPPLY	LPS with I²C slave address 0x28: Over-temperature on heatsink PFC and LPS primary.
- L	ERROR(-2752) LAMP POWER SUPPLY	LPS with I²C slave address 0x28: Over-temperature in transformer LPS.
- L	ERROR(-2753) LAMP POWER SUPPLY	LPS with I²C slave address 0x28: Over-temperature on heatsink LPS secondary diode.
- L	ERROR(-2801) START PFC NOT OK	LPS with I²C slave address 0x28: Start-up of the PFC module failed.
- L	ERROR(-2802) START LPS NOT OK	LPS with I²C slave address 0x28: Start-up of the LPS module failed.
- L	ERROR(-2803) START BOOST NOT OK	LPS with I²C slave address 0x28: Start-up of the BOOST module failed.
- L	ERROR(-2806) LAMP IGNITION FAILED	LPS with I²C slave address 0x28: Ignition of the lamp failed.
- L	ERROR(-2807) LAMP VOLTAGE OUT RANGE	LPS with I²C slave address 0x28: The voltage at the lamp is too high.
- L	ERROR(-2808) LAMP POWER OUT RANGE	LPS with I²C slave address 0x28: The power at the lamp is too high.
- L	ERROR(-2809) OVERTEMP IN LPS	LPS with I²C slave address 0x28: Temperature in LPS is too high.
- L	ERROR(-2810) HTSNK OVERTEMP LPS	LPS with I²C slave address 0x28: Heatsink temperature in LPS is too high..
- L	ERROR(-2811) AMBIENT OVERTEMP LPS	LPS with I2C slave address 0x28: Ambient Temperature in LPS is too high.
- L	ERROR(-2812) FAN ERROR LPS	LPS with I²C slave address 0x28 :Fan error
- P	ERROR(-3001) SMPS FAILED	The SMPS has unexpectedly shut down.
- P	ERROR(-3002) SMPS START FAILED	Unable to start the SMPS.
- P	ERROR(-3003) SMPS OUTPUT SHORTED	The output of the SMPS is shorted.
- P	ERROR(-3004) TOP FAN ERROR	The Fan on top of the lamp is not working.
- P	ERROR(-3005) ANODE FAN ERROR	The Fan at the anode of the lamp is not working.

Info Display	LCD Display	Error Description
- P	ERROR(-3006) CATHODE FAN ERROR	The Fan at the cathode of the lamp is not working.
- P	ERROR(-3007) SMPS IN ISP MODE	The SMPS is in the “In System Programming” mode.
- H	ERROR(-4000) INCOMPATIBLE HARDWARE	Incompatible hardware was found.
- H	ERROR(-4001) PLD CONFIGURE	Unable to configure one or more PLD’s. (PLD = Programmable Logic Device)
- H	ERROR(-4002) INCOMPATIBLE HARDWARE	Incompatible hardware was found: Backplane
- H	ERROR(-4003) INCOMPATIBLE HARDWARE	Incompatible hardware was found: Identification
- H	ERROR(-4004) SMPS EEPROM CORRUPT	Data in SMPS EEPROM is corrupt
- H	ERROR(-4005) WRONG SMPS VERSION	The SMPS is not compatible with this projector
- H	ERROR(-4006) OLD INPUT	An input module is not compatible with this projector
- H	ERROR(-4100) VOLTAGE ERROR	Voltage FAN 1 is too high
- H	ERROR(-4101) VOLTAGE ERROR	Voltage FAN 2 is too high
- H	ERROR(-4102) VOLTAGE ERROR	Voltage FAN 3 is too high
- H	ERROR(-4103) VOLTAGE ERROR	Voltage +15V is too high
- H	ERROR(-4104) VOLTAGE ERROR	Voltage +30V is too high
- H	ERROR(-4105) VOLTAGE ERROR	Voltage +12V is too high
- H	ERROR(-4106) VOLTAGE ERROR	Voltage +12V is too high
- H	ERROR(-4107) VOLTAGE ERROR	Voltage +3V3 is too high
- H	ERROR(-4108) VOLTAGE ERROR	Voltage FAN 1 is too low
- H	ERROR(-4109) VOLTAGE ERROR	Voltage FAN 2 is too low
- H	ERROR(-4110) VOLTAGE ERROR	Voltage FAN 3 is too low

Info Display	LCD Display	Error Description
- H	ERROR(-4111) VOLTAGE ERROR	Voltage +15V is too low
- H	ERROR(-4112) VOLTAGE ERROR	Voltage +30V is too low
- H	ERROR(-4113) VOLTAGE ERROR	Voltage +12V is too low
- H	ERROR(-4114) VOLTAGE ERROR	Voltage +5V is too low
- H	ERROR(-4115) VOLTAGE ERROR	Voltage +3V3 is too low
- t	ERROR(-5001) DMD TEMPERATURE	The temperature of one or more DMD's is out of range.
- t	ERROR(-5002) AMBIENT OVERTEMP	The ambient temperature is too high.
- t	ERROR(-6000) TILT ERROR	The projector is not correctly positioned.

8.4.2 Error List on INFO display Only

Error List

The first column of this table represents the two characters displayed on the information display and the second column the fault description which is NOT displayed in the LCD display.

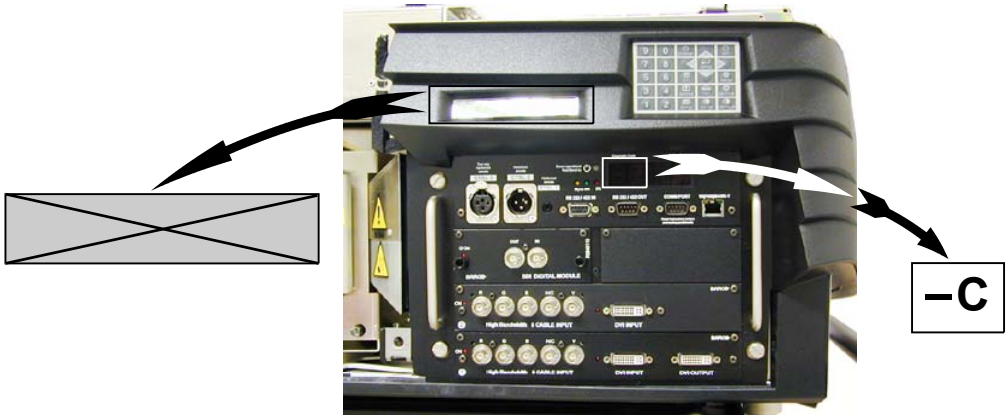


Image 8-7
Display fault analysis

Info Display	Error	Error Description
- c	I²C ERROR SCL Line	The I²C SCL line doesn't react (held down), so no I²C communication is possible.
- d	I²C ERROR SDA Line	The I²C SDL line doesn't react (held down), so no I²C communication is possible.
- H	"Hardware" ERROR	Indicates an error concerning the hardware. This can be: • incompatible hardware found • hardware failure

Info Display	Error	Error Description
- L	"Lamp" ERROR	Indicates an error concerning the lamp. This can be: • an error concerning the LPS • an error on the lamp info module If it concerns an error on the lamp info module, "Wrong Lamp Parameter(s) is displayed on the LCD display.
- P	SMPS ERROR	Indicates an error concerning the SMPS.
- t	Temperature ERROR	Projector has been shut down due to temperature reasons. This can be: • DMD temperature is out of range.
E 1	Formatter ERROR	Indicates an error concerning the formatter. This can be: • No I2C communication (no acknowledge) with the formatter board • Formatter error (see menu "SERVICE/DIAGNOSIS/FORMATTER")
E 2	I^2C Panellink Out	No I^2C communication (no acknowledge) with Panellink Out EEPROM.
E 3	I^2C AD9887	No I^2C communication (no acknowledge) with device AD9887 on input selector slot 1 and 2.
E 4	I^2C Video Input	No I^2C communication (no acknowledge) with video input on slot 3 and 4.
E 5	I^2C Decoder	No I^2C communication (no acknowledge) with decoder.
E c	I^2C SCL Line	The I^2C SCL line doesn't react (held low), so no I^2C communication is possible.
E d	I^2C SDA Line	The I^2C SDA line doesn't react (held low), so no I2C communication is possible.
E L	LPS down, reduced power	At least one LPS gone down. The projector continues with reduced power.
F 2	I^2C Motor Driver	No I^2C communication (no acknowledge) with motor driver.
F 4	CPU Flash read	
F 5	CPU Flash write	
F 6	CPU Flash clear	
F 7	CPU Flash format	
F 8	CPU Flash command busy	
F 9	CPU Flash command time out	
H 0	COMM PORT TX Busy	The TX-Line of the COMM PORT is still busy when a new transmission has to take place.
H 1	COMM PORT RX Timeout	The slave device connected to the COMM PORT didn't respond after a request sent by the projector.
H 2	COMM PORT RX Data	The slave device connected to the COMM PORT sent an unknown answer after a request sent by the projector.
H 3	COMM PORT RX Error	The slave device connected to the COMM PORT answered with the "RX error byte" after a request sent by the projector.
H 4	COMM PORT Source Number	The projector tries to send a wrong source selection request to the slave device connected to the COMM PORT.
H 5	COMM PORT TX Timeout	The projector is unable to send a command to the slave device connected to the COMM PORT (transmission failure).

9. COMMUNICATION MODULE R763768

9.1 General Info

View of the Communication module

Image 9-1
Front view Communication module

View of the modules

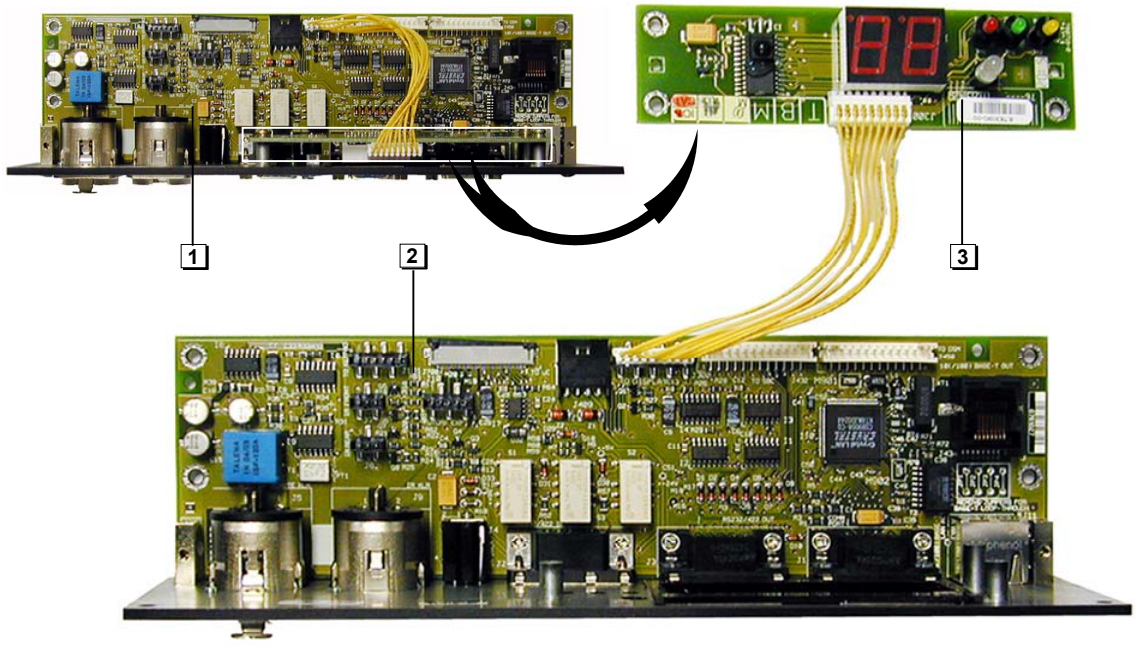


Image 9-2
View of the assembly

Picture Ref.	Article No	Identification
1	R763768	Communication Interface complete (+ Display)
2	R763766	Communication main module
3	R763090	Communication display

9.2 Interconnection with CPU

Interconnection diagram

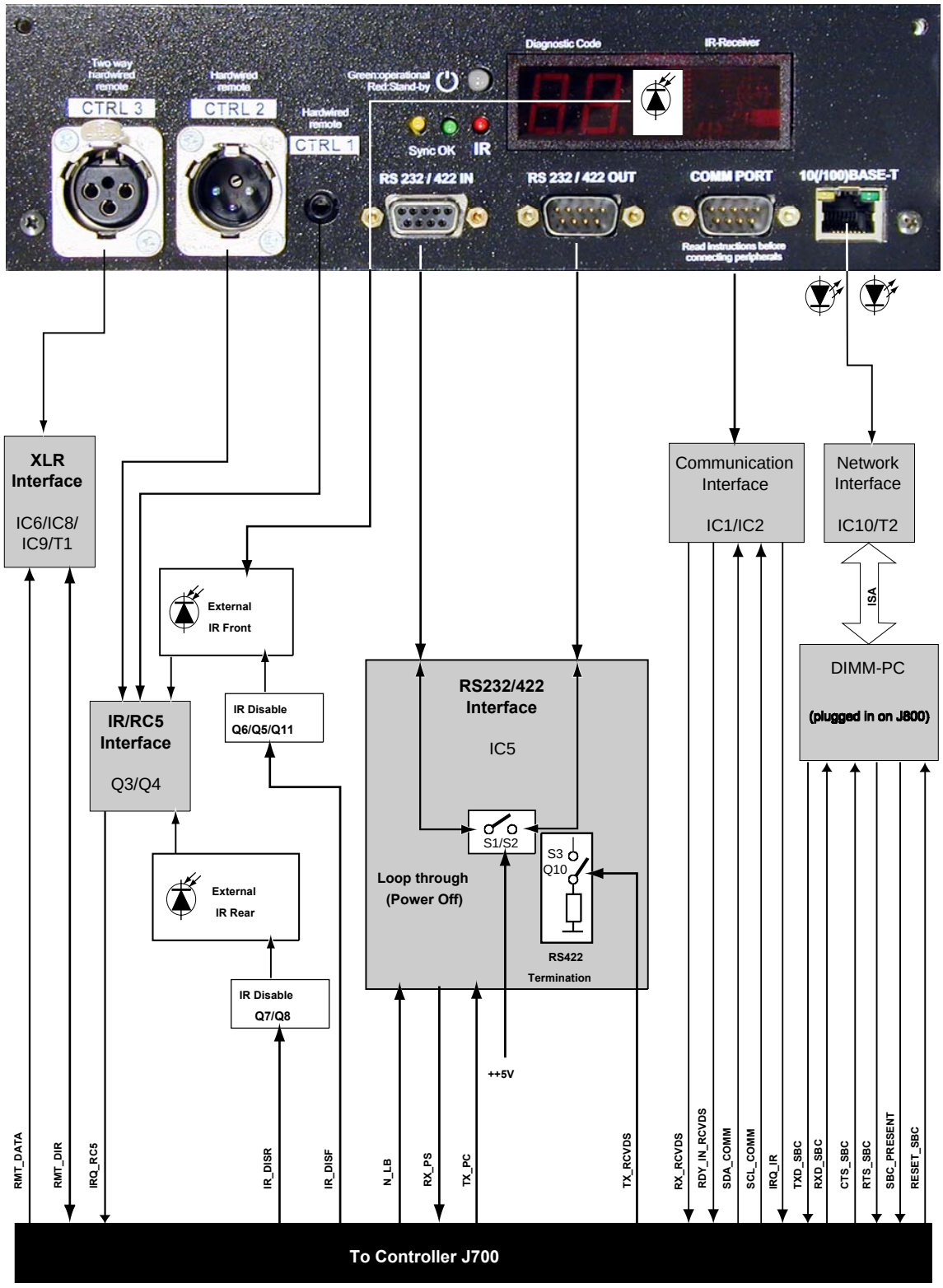


Image 9-3
Interconnection with CPU

9.3 Technical description

Introduction

This unit makes it possible to communicate with the projector. You can interface with the projector in several ways:

- Communication port : communication with Barco equipment (RCVDS, …)
- RS232 and RS422 port with active and passive loop through
- Infrared (IR) receivers at the front and rear side of the projector
- Local keypad with LCD display
- Wired remote control via jack or XLR plug
- Rugged wired remote with local keypad and LCD display
- Error display
- Optional Network Interface

RCVDS Communication

- If the RCVDS is present, the RDY line is pulled high. This switches the TX_RCVDS signal to pin 3 of the comm. port connector. If an external information display is connected, the RDY line is pulled low thereby switching the SDA_COMM line to pin 3.
- The PPM or RC5 signal on pin 1 is AC coupled by C1 and clamped between 0V and 3.3V by D10 and D9-Z4. This is done to get good communication across long cables.
- All inputs and outputs are protected by series resistors and diodes. The ++24V is short circuit protected by PT2. The ++9V also has short circuit protection in I7.

RS232/422 Communication

- The RS232 and RS422 signal levels are converted into TTL levels and visa versa by means of I5. It can by switched between the two RS modes by means of the RS422_SEL line. The signals also have an active loop-through between J2 and J3.
- With the N_LB line the RS drivers in I5 can be tested. The TX_PC signal is looped back to the RX_PC line through the internal drivers without changing the external RS signals.
- With power off, the TXD and RXD lines are looped through between J2 and J3 by means of relays S1 and S2. The outputs of I5 are in high impedance mode at that time.
- The RS422 inputs can be terminated with a 120 Ohm resistor through relay S3. It can be selected with the RS422_TERM line only in the RS422 mode.
- All inputs are protected by series resistors and diodes.

IR Reception

- All RC5 signals are added onto the IRQ_RC5 line coming from the local keypad and going to the controller. It is pulled high by R9 and made glitch-free by means of C3.
- The RC5 signal coming from the jack or XLR wired remote is detected via the current sense resistors R10 and R11. The signal is then AC coupled by C2 , clamped with D33 and drives the transistor Q3. On the base of Q4 the RC5 signals of Q3 and the IR receivers are combined.
- The signals IR_FRONT and IR_REAR can come from the connectors J7 and J6 or from the flexfoil connector J700. For direct connection with a processor board the 0 Ohm resistors R61 and R62 have to be removed.
- The IR receivers can be switched off only if a wired remote control is connected. Only then are Q6 and Q8 in the off state. This is why, in case of the XLR connection, pin 3 has to be externally connected to ground. The rear receiver can be disabled with the IR_DISR line, the front and display receivers can be disabled with the IR_DISF line. The transistors Q7, Q5 and Q11 take care of that.

ERROR display connection

- The two 7 segment displays are controlled by the I2C lines SDA_ERROR and SCL_ERROR coming from the processor board.
- The red IR-received led is activated by a mmv of I4 triggered on the RC5 or PPM signal.
- The green IR-accepted led is also activated by a second mmv of I4 triggered on the IR_OK line coming from the processor.
- The yellow sync-present led is directly controlled by the L_YEL line.
- The two-colored standby led is controlled by the /PMP_PE line. It also drives the RI signal on the RS232 port (pin 9) and the TRIGGER OUTPUT port.

Remote XLR connection

- The direction of communication is determined by the RMT_DIR line. A low puts the interface in receiving mode, a high in transmitting mode. All data is put on the RMT_DATA line.
- The TTL level of the data is translated into a differential voltage by I6 and is then superimposed onto the ++24V supply by transformer T1. Capacitors C14, C15 and C16 block the DC current in order not to saturate the transformer.
- Because of the transformer it is also necessary to hold the DC level of the signal constant. That is why a zero bit is transmitted as half the bit-time a low level and half the bit-time a high level. This is achieved with a mmv of I8 (pin 1-7). In receiving mode a zero bit is stretched to the full bit-time by the second mmv of I8.
- Because of the fixed delays of I8 the communication baudrate is also fixed to 57600 baud.

Power Supply

- The main power supply is the ++5V coming from the SMPS. It is protected against overvoltage by the transorb Z3.
- The ++24V from the SMPS is used for supplying power to the comm port and the remote XLR port. They are separately protected against short circuit by the PTC fuses PT1 and PT2.
- The ++9V for the comm port and IR wired remote is taken from the ++24V. It is stabilized and short circuit protected by I7.

Ethernet LAN controller for PC card

An Ethernet LAN controller, IC10 CS8900A, is provided on board. This offers a 10-base T input connection to connect the projector to the corporate network (LAN). Thanks to the optional network interface, the SLM projector becomes an IP-addressable device.

The CS8900A includes on-chip RAM, 10BASE-T transmit and receive filters, and a direct ISA-Bus interface with 24 mA Drivers.

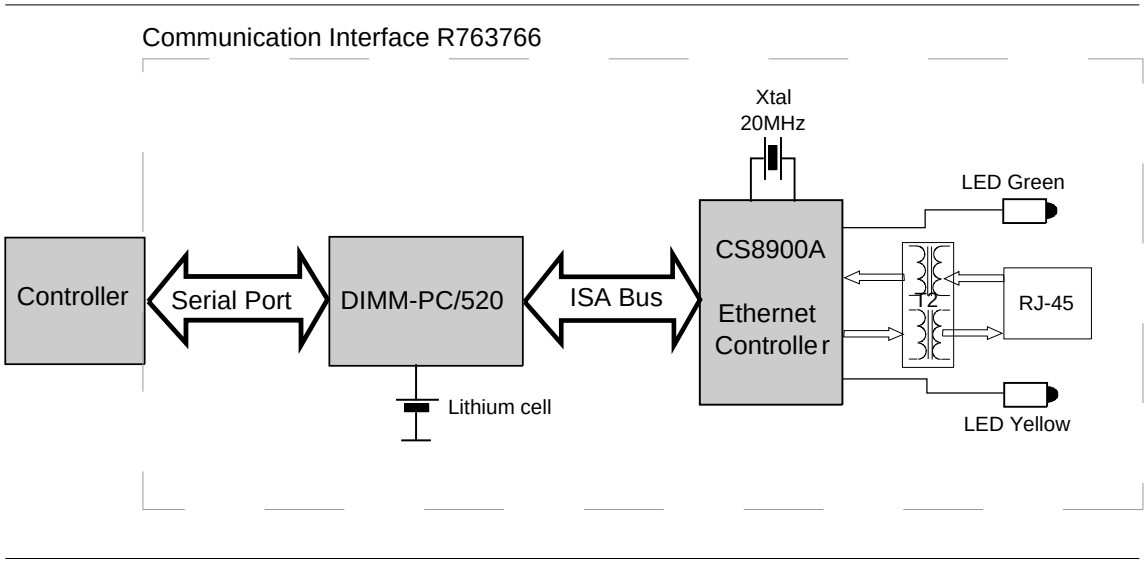


Image 9-4
DIMM-PC interconnection

Block diagram info:

- Green LED: detection of the presence of a valid link.
  Yellow LED: detection of network activity
- Galvanic separation with transormer T2
- Serial port with the Controller: RXD_SBC, TXD_SBC.....
- Module detection with Q12 & Q13: when SYSCLK is presence, the transistor Q12 is saturated whereas SBC_PRESENT is high.
- A lithium cell ensure real-time clock for the DIMM-PC.

9.4 On board connector pin assignment

Input Connectors

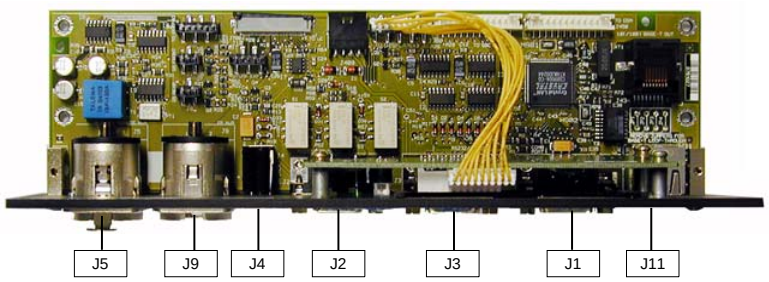


Image 9-5
On board connector pin assignment

Input Connector J1 - CommunicatioGroundn Port				
Pin Name	**Pin No**	**In/out**	**Definition**	**Signal**
N_PPM/RC5	1	In	PPM or RC5 from RCVDS	TTL
TXD	2	In	Transmit data from RCVDS	TTL
RXD/SDA	3	Out	Receive data or I²C SDA to RCVDS	TTL
++9V	4	Out	Power supply	+9V - 0.1 A max.
GND	5		Ground	
SCL	6	In	I²C SCL to RCVDS	TTL
RDY	7	Out	Selection I²C or serial	TTL
++24V	8		Power supply	+24V- 0.17A max.
GND	9		Ground	

Input Connector J2 - RS232/422 In				
Pin Name	**Pin No**	**In/out**	**Definition**	**Signal**
DCD	1	Out	Data Carrier Detect	RS232
RXD-	2	Out	Receive Data (inverted)	RS422/232
TXD-	3	In	Transmit Data (inverted)	RS422/232
TXD+/DTR	4	In	Transmit Data+/ Data Terminal Ready	RS422/232
GND	5		Ground	
RXD+/DSR	6	Out	Receive data+ / Data Set Ready	RS422/232
RTS	7	In	Not connected	
CTS	8	Out	Clear To Send	RS232
RI	9	Out	Ring Indicator (+9V with power on)	RS232

Input Connector J3 - RS232/422 Out				
Pin Name	**Pin No**	**In/out**	**Definition**	**Signal**
RXD-	2	In	Receive Data (inverted)	RS422/232
TXD-	3	Out	Transmit Data (inverted)	RS422/232
TXD+/DTR	4	Out	Transmit Data+/ Data Terminal Ready	RS422/232

Input Connector J3 - RS232/422 Out				
GND	5		Ground	
RXD+/DSR	6	In	Receive data+ / Data Set Ready	RS422/232
NC	1,7-9		Not connected	

Input Connector J4 - IR Jack				
Pin Name	**Pin No**	**In/out**	**Definition**	**Signal**
N_RC5	1	In	RC5 input (current driver)	
INFO_JACK	2	Out	Info on jack present	0/+9V
GND	4		Ground	

Input Connector J5 -Remote XLR				
Pin Name	**Pin No**	**In/out**	**Definition**	**Signal**
GND	1		Ground	
R/TXD+	2	In/Out	Receive/Transmit Data (non-inverted)	AC+24VDC
R/TXD-	3	In/Out	Receive/Transmit Data (inverted)	AC+24VDC

Input Connector J9 - IR XLR				
Pin Name	**Pin No**	**In/out**	**Definition**	**Signal**
GND	1		Grounf	
N_RC5	2	In	RC5 input (current driver)	
INFO_XLR	3	In	Info on XLR present	0/+9V

Input Connector J11 -10(/100) BASE-T				
Pin Name	**Pin No**	**In/out**	**Definition**	**Signal**
TXD+	1		Transmit Data	(non-inverted)
TXD-	2	In	Transmit Data	(inverted)
RXD+	3	In	Receive Data	(non-inverted)
RXD-	6		Receive Data	(inverted)
GND	13		Ground	

Interconnection with CPU & Local Keypad

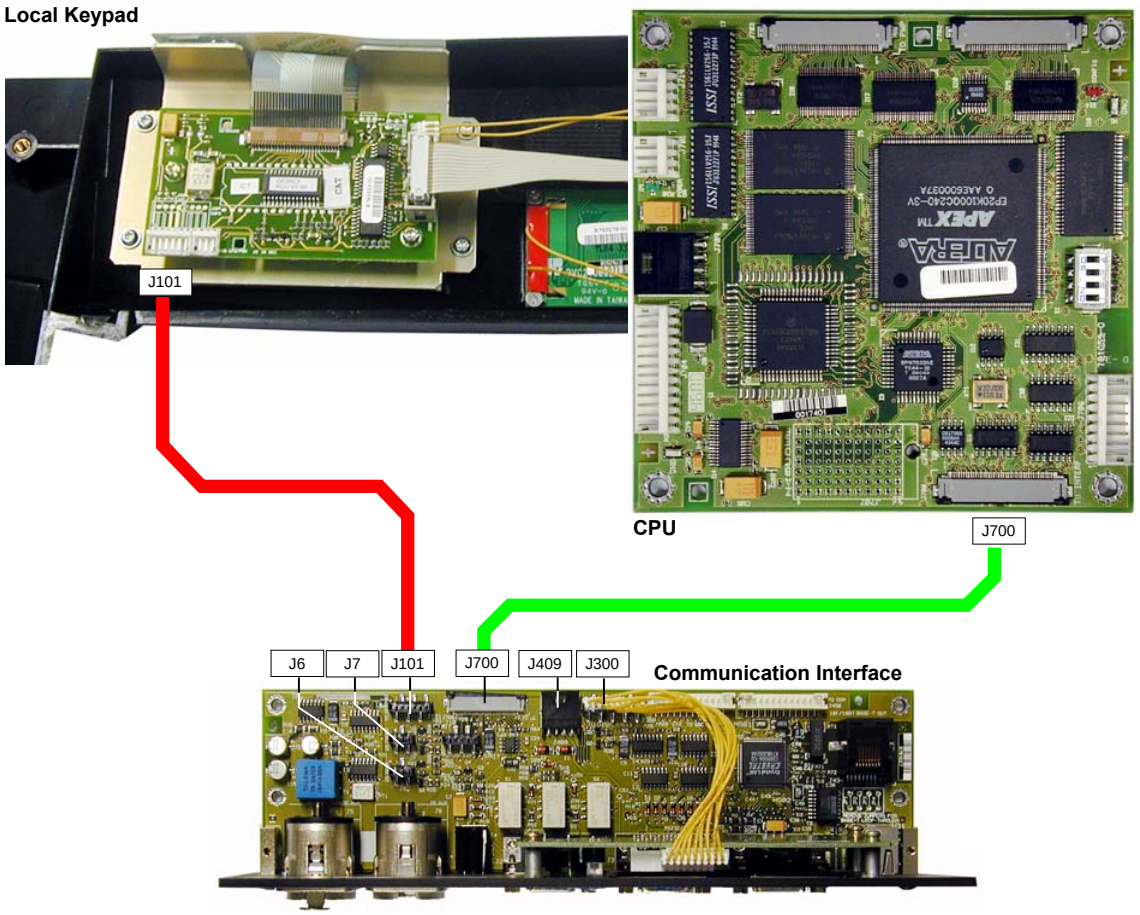


Image 9-6
Interconnection with CPU & Local Keypad

Connector J101 - from Local Keypad				
Pin Name	**Pin No**	**In/out**	**Definition**	**Signal**
GND	1		Ground	
AMB_LIGHT	2	In	Ambient light info from local keypad	TTL
IRQ_RC5	3	In	RC5 signal from local keypad	TTL
++5V	4	Out	Power supply	+5V
SDA_ERROR	5	Out	I2C SDA signal to lcd display	TTL
SCL_ERROR	6	Out	I2C SCL signal to lcd display	TTL

Connector J700 - Interconnection CPU/Local Keypad				
Pin Name	**Pin No**	**In/out**	**Definition**	**Signal**
GND	1-2		Ground	
TX_RCVDS	3	In	Ambient light info from local keypad	TTL
RX_RCVDS	4	Out	RC5 signal from local keypad	TTL
RDY_IN_RCVDS	5	Out	Power supply	+5V
TX_PC	6	In	I2C SDA signal to lcd display	TTL
RX_PC	7	Out	I2C SCL signal to lcd display	TTL

Connector J700 - Interconnection CPU/Local Keypad				
GND	8			
SDA_ERROR	9	In	I2C SDA signal to display	TTL
SCL_ERROR	10	In	I2C SCL signal to display	TTL
SCL_COMM	11	In	I2C SCL signal to comm port	TTL
SDA_COMM	12	In	I2C SDA signal to comm port	TTL
IR_DISF	13	In	Disable front IR receiver	TTL
/PMP_PE	14	In	Power on signal	TTL
IR_OK	15	In	Signal to green led (IR accepted)	TTL
IRQ_IR	16	Out	PPM or RC5 from RCVDS	TTL
IR_DISR	17	In	Disable rear IR receiver	TTL
IRQ_RC5	18	Out	RC5 from IR receivers and local keypad	TTL
IR_FRONT	19	In	RC5 from front IR receiver	TTL
IR_REAR	20	In	RC5 from rear IR receiver	TTL
AMB_LIGHT	21	Out	Ambient light info from local keypad	TTL
L_YEL	22	In	Signal for yellow led (sync present)	TTL
RS422_SEL	23	In	Selection of RS422 or RS232	TTL
RS422_TERM	24	In	Selection of RS422 termination on/off	TTL
N_LB	25	In	Not_Loop Back – Selection of the self test function of RS driver	TTL
RMT_DIR	26	In	Selection of wired remote transmit or receive	TTL
RMT_DATA	27	In/Out	Serial data from and to wired remote	TTL
	28-38		Future expansion	
GND	39,40		Ground	

Interconnection with Input Backplane

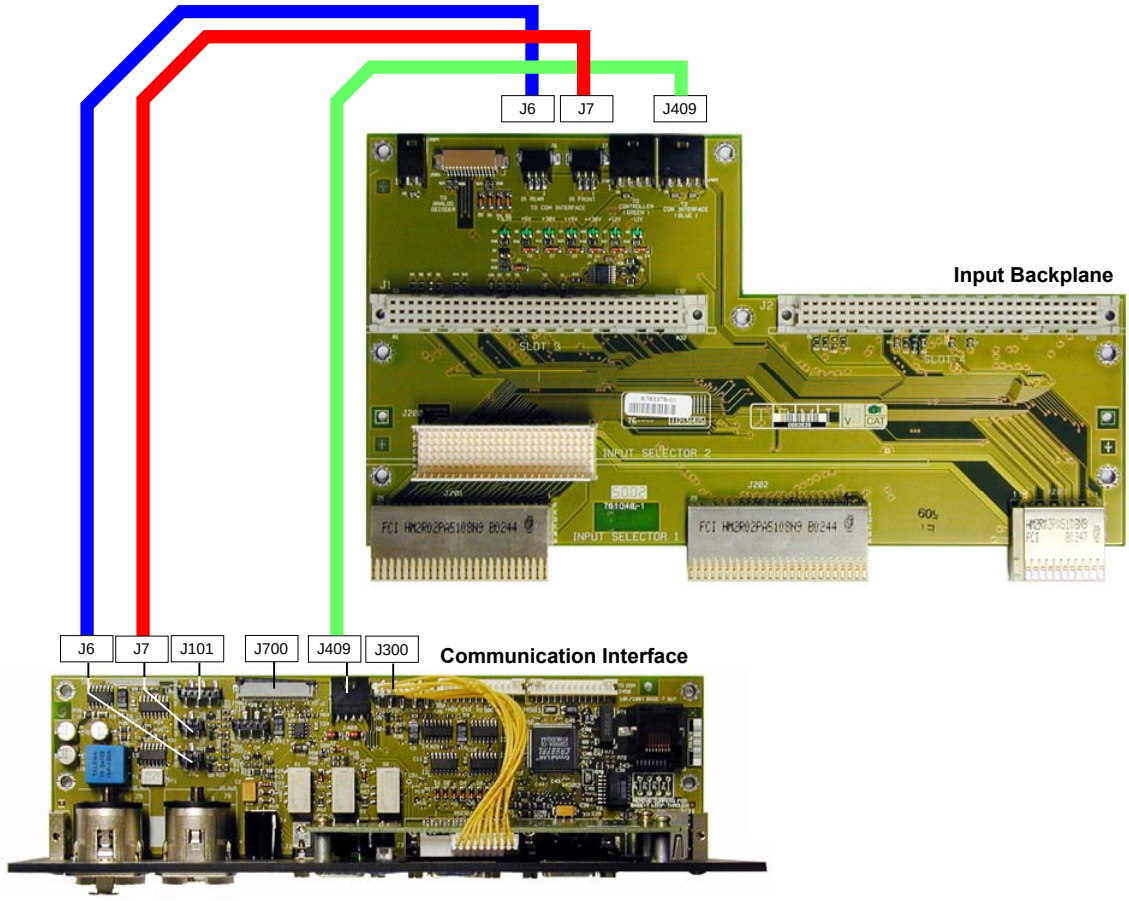


Image 9-7
Interconnection with Input Backplane

Connector J6 - IR Receiver Rear				
Pin Name	**Pin No**	**In/out**	**Definition**	**Signal**
++5V	1	In	Power supply	+5V
IR_REAR	2	In	RC5 signal from rear IR receiver	TTL
GND	3		Ground	

Connector J6 - IR Receiver Front				
Pin Name	**Pin No**	**In/out**	**Definition**	**Signal**
++5V	1	In	Power supply	+5V
IR_REAR	2	In	RC5 signal from front IR receiver	TTL
GND	3		Ground	

Connector J300 - to Display				
Pin Name	**Pin No**	**In/out**	**Definition**	**Signal**
L_YEL	1	Out	Signal for yellow led (sync present)	TTL
GND	2	Out	Ground	
L_IR_OK	3	Out	Signal for green led (IR accepted)	TTL
L_IR_REC	4	Out	Signal for red led (IR received)	TTL

Connector J300 - to Display				
L_PWR_ON	5	Out	Signal for standby led (power on/off)	TTL
SCL_ERROR	6	Out	I2C SCL signal to error display	TTL
SDA_ERROR	7	Out	I2C SDA signal to error display	TTL
IR_DISPLAY	8	In	RC5 signal from IR receiver on display unit	TTL
++5V	9	Out	Power supply	+5V

Connector J409 - Power Connection				
Pin Name	**Pin No**	**In/out**	**Definition**	**Signal**
++5V	1	In	Standby 5V power supply 0.2A max.(exc display,..) 0.6A max.(inc display,..)	+5V
NC	2	In	Not connected	
++24V	3	In	Standby 24V power supply	+24V – 0.32A max
GND	4		Ground	

9.5 On board Information Display

9.5.1 View of the board

Top view Board

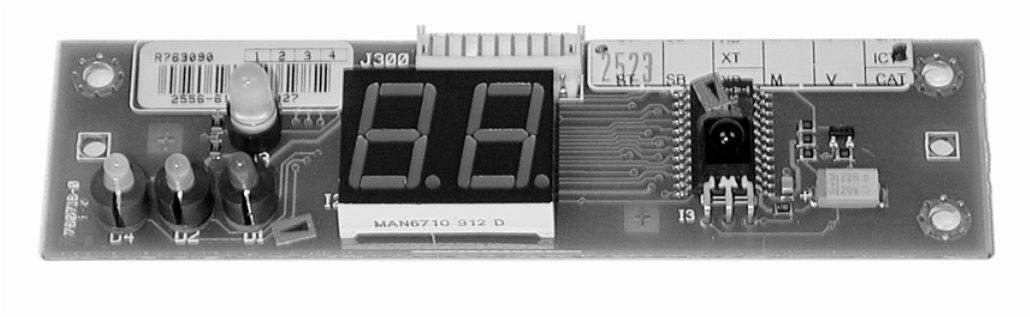


Image 9-8
Top view Information Display board

9.5.2 Technical Info

Functionality on board

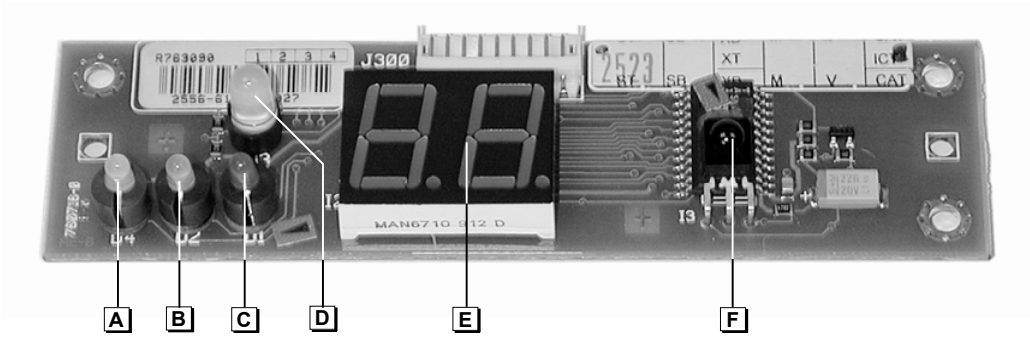


Image 9-9
Functions on Display board

This unit contains two seven segment led display (E), four normal LEDs (A..D) and an IR receiver (F). The display is used to show the status of the projector for instance the selected input number, error codes, ….

The four normal leds each have a specific function:

- IR received (red) (C): Infrared signal or local keypad signal is detected (any address)
- IR accepted (green) (B): Infrared signal is accepted (own address)
- Sync detected (yellow) (A): There is a stable sync present on the selected input
- Power (red/green) (D): red is projector standby, green is projector active

The IR receiver can accept RC5 code. It is positioned next to the display in order to receive the IR signal through the same red glass as the display.

On board connector pin assignment

Connector J300 - to Communication Interface				
Pin Name	**Pin No**	**In/out**	**Definition**	**Signal**
L_YEL	1	Out	Signal for yellow led (sync present)	TTL
GND	2	Out	Ground	
L_IR_OK	3	Out	Signal for green led (IR accepted)	TTL
L_IR_REC	4	Out	Signal for red led (IR received)	TTL
L_PWR_ON	5	Out	Signal for standby led (power on/off)	TTL
SCL_ERROR	6	Out	I2C SCL signal to error display	TTL
SDA_ERROR	7	Out	I2C SDA signal to error display	TTL
IR_DISPLAY	8	In	RC5 signal from IR receiver on display unit	TTL
++5V	9	Out	Power supply	+5V

9.5.3 Error List on INFO display Only

Overview

The following error codes are shown on the two seven segment led display:

Info Display	Error	Error Description
- c	I²C ERROR SCL Line	The I²C SCL line doesn't react (held down), so no I²C communication is possible.
- d	I²C ERROR SDA Line	The I²C SDL line doesn't react (held down), so no I²C communication is possible.
- H	"Hardware" ERROR	Indicates an error concerning the hardware. This can be: • incompatible hardware found • hardware failure
- L	"Lamp" ERROR	Indicates an error concerning the lamp. This can be: • an error concerning the LPS • an error on the lamp info module If it concerns an error on the lamp info module, "Wrong Lamp Parameter(s) is displayed on the LCD display.
- P	SMPS ERROR	Indicates an error concerning the SMPS.
- t	Temperature ERROR	Projector has been shut down due to temperature reasons. This can be: • DMD temperature is out of range.

Info Display	Error	Error Description
E 1	Formatter ERROR	Indicates an error concerning the formatter. This can be: • No I2C communication (no acknowledge) with the formatter board • Formatter error (see menu "SERVICE/DIAGNOSIS/FORMATTER")
E 2	I²C Panellink Out	No I²C communication (no acknowledge) with Panellink Out EEPROM.
E 3	I²C AD9887	No I²C communication (no acknowledge) with device AD9887 on input selector slot 1 and 2.
E 4	I²C Video Input	No I²C communication (no acknowledge) with video input on slot 3 and 4.
E 5	I²C Decoder	No I²C communication (no acknowledge) with decoder.
E c	I²C SCL Line	The I²C SCL line doesn't react (held low), so no I²C communication is possible.
E d	I²C SDA Line	The I²C SDA line doesn't react (held low), so no I2C communication is possible.
E L	LPS down, reduced power	At least one LPS gone down. The projector continues with reduced power.
F 2	I²C Motor Driver	No I²C communication (no acknowledge) with motor driver.
F 4	CPU Flash read	
F 5	CPU Flash write	
F 6	CPU Flash clear	
F 7	CPU Flash format	
F 8	CPU Flash command busy	
F 9	CPU Flash command time out	
H 0	COMM PORT TX Busy	The TX-Line of the COMM PORT is still busy when a new transmission has to take place.
H 1	COMM PORT RX Timeout	The slave device connected to the COMM PORT didn't respond after a request sent by the projector.
H 2	COMM PORT RX Data	The slave device connected to the COMM PORT sent an unknown answer after a request sent by the projector.
H 3	COMM PORT RX Error	The slave device connected to the COMM PORT answered with the "RX error byte" after a request sent by the projector.
H 4	COMM PORT Source Number	The projector tries to send a wrong source selection request to the slave device connected to the COMM PORT.
H 5	COMM PORT TX Timeout	The projector is unable to send a command to the slave device connected to the COMM PORT (transmission failure).

10. SERIAL DIGITAL INPUT MODULE R7632485

10.1 General Info

View of the SDI Input module

Front view

Rear view

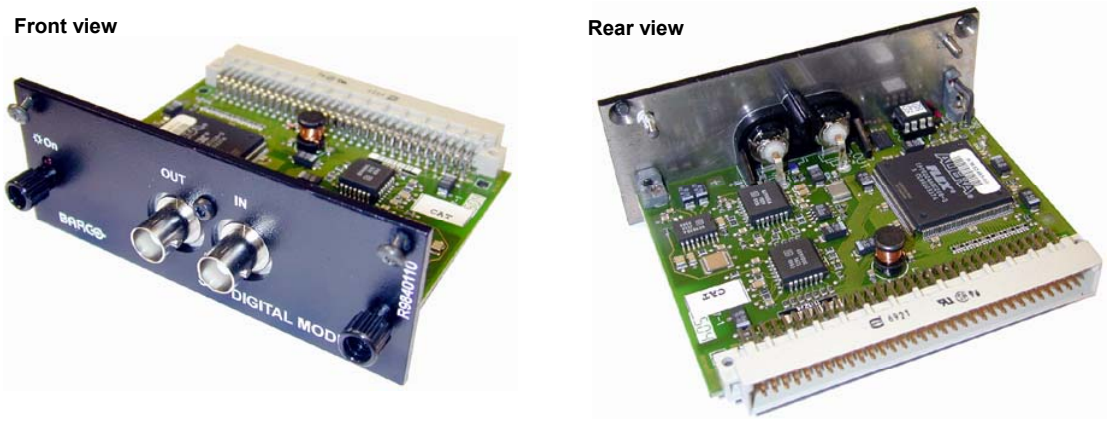


Image 10-1
View SDI input module

10.2 Technical Info

Technical description

This interface is made for serial digital video (4:2:2) according to SMPTE259 (270Mbit/s).

The input signal is amplified (with equalizer) and sampled with a regenerated clock. A copy of the regenerated input signal is buffered to a BNC-output. The serial bitstream is transformed into a parallel 10-bit YCbCr stream. Horizontal, vertical sync and field signal are derived from the 10-bit stream. The YCbCr stream is decoded into RGB signals which connect to the PMP through an Euro connector. Contrast, saturation and brightness adjustment are possible.

Horizontal and vertical sync are both active high during blanking. The field signal is high during field 1 and low during field 2.

LEDs on board

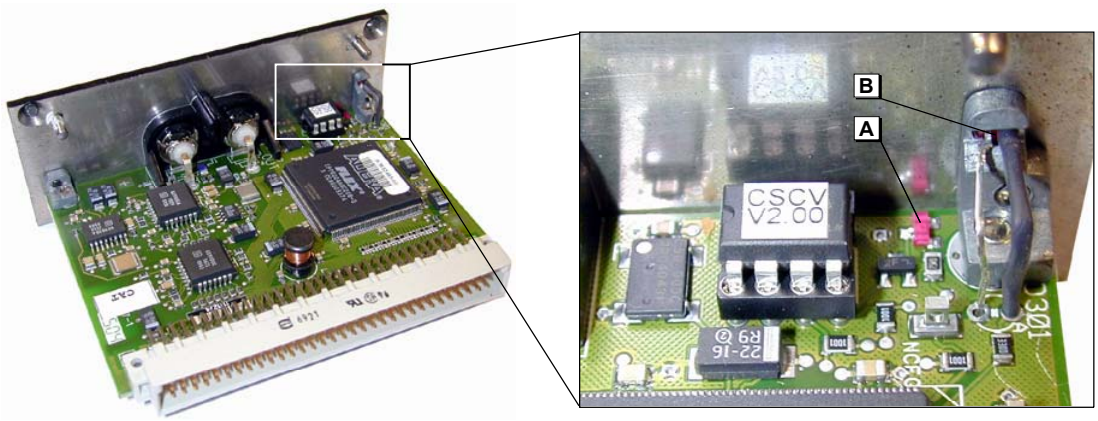


Image 10-2
LEDs on board

On this PCB, 2 red LEDs are present.

- SMD LED (D300) (A) which indicates whether the FPGA is configured or not. When the LED is “on”, the FPGA is NOT configured.
- Discrete LED (D301) (B), visible from the outside via an aperture in the front plate, indicates whether the SDI module is selected or not. When the LED is “on”, the module is selected.

Power Supply

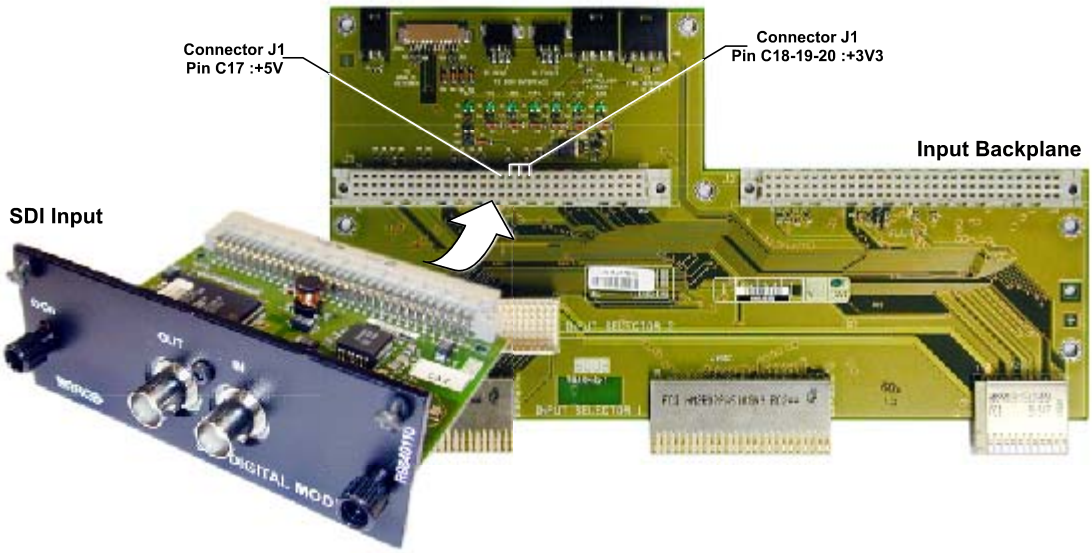


Image 10-3
SDI input Power supply

The SDI input module receives its power supply via the on board Euro connector which is plugged in onto the Euro connector J1 on the input backplane

Connector J1 on Input Backplane	
Pin C17	+5V
Pin C18–C19–C20	+3V3

11. SIGNAL INPUT SELECTION R763850 & R763851

11.1 General Info

Introduction

The full input section comprises two 5-cable fixed BNC inputs and two digital slots to insert (optional) digital modules like the SDI / H-SDI or another digital decoder. On the input selection module 1 & 2 there is also a DVI IN available and only on the input selection module 1 a DVI OUT. A digital decoder R763826 is connected to each of the input boards. Video or S-video signals are processed in this digital decoder board to re-enter this input board where they are buffered in order to add them to the digital RGB_ ANA.

View of the Signal Input modules

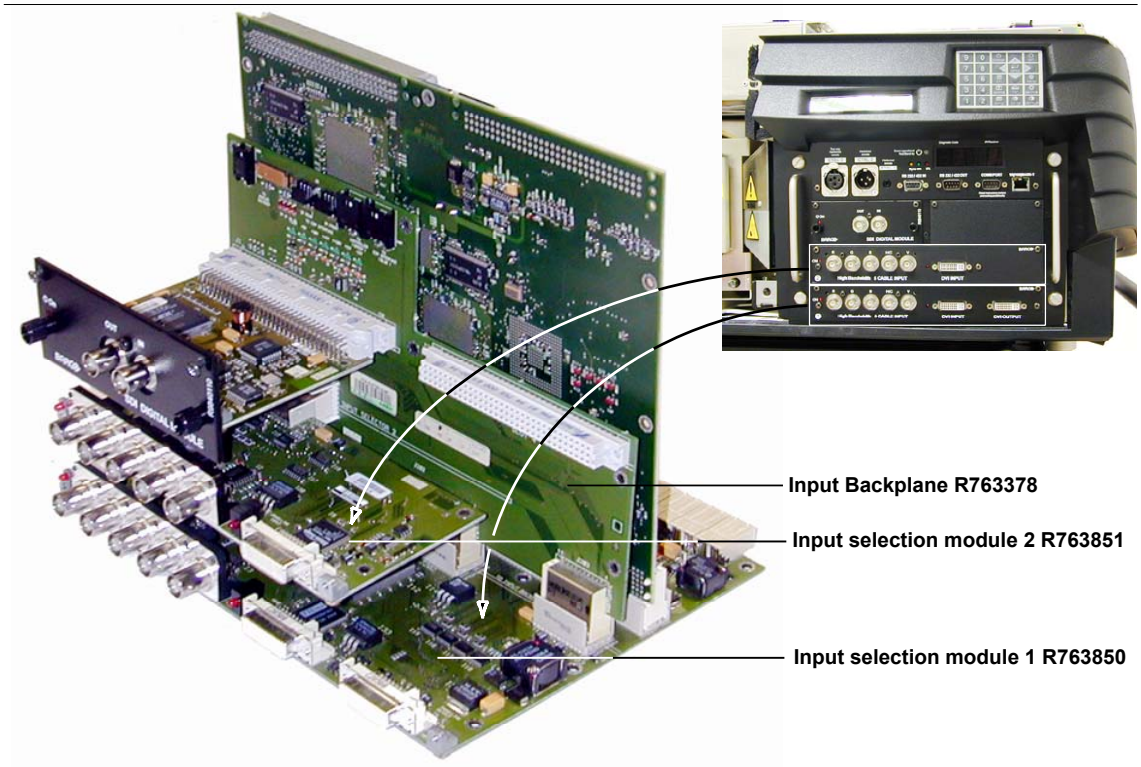


Image 11-1
Overview Signal Input modules

11.2 Block Diagram Signal Input Selection 1 & 2

Block diagram

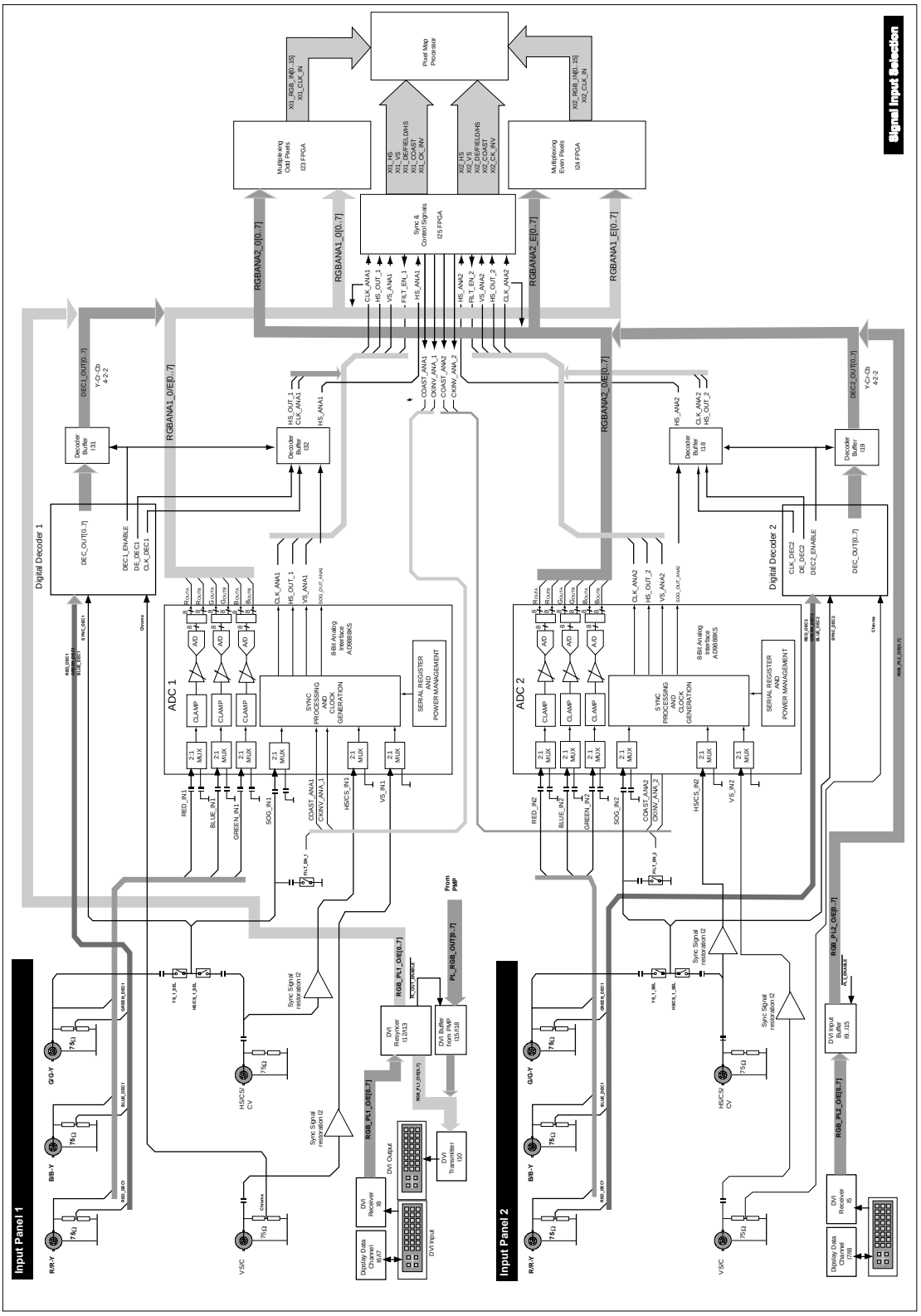


Image 11-2
Block diagram Signal Input selection 1& 2

11.3 Technical Description Input Selector 1 & 2

11.3.1 Technical Description Input Selector 1

11.3.1.1 General Description

General description

The full input section comprises two (-cable fixed BNC inputs and two digital slots to insert (optional) digital modules like the SDI / H-SDI or another digital decoder. On input 1 there is also a DVI / OUT available and input 2 has a DVI IN only. A digital decoder R763826 is connected to each of the input boards. Video or S-video signals are processed in this digital decoder board to re-enter this input board where they are buffered in order to add them to the digital RGB_ ANA1 bus.

The RGB computer input signals are converted into a 48-bit (3x2x8) digital RGB format. They are then multiplexed together with three other 48 digital RGB channels onto two 48-bit digital RGB outputs for the Pixel Map Processor.

Besides signal processing, the board also handles the sync processing and multiplexing (=selection) of the sync for the AMDS (source identification) on the PMP.

The 5-cable input can handle all possible analog input signals: RGBHV, RGBCS, RGBCV, RGsB, YUVCS, YsUV, video and S-video.

The RGB and YUV signals are sent to an ADC (Analog to Digital Converter).

The PanelLink*[1] or DVI input allows a direct digital interfacing with a DVI output of a PC card or other devices equipped with DVI outputs, such as scalers.

The PanelLink* signals are also processed by a DVI receiver chip set. An FPGA is then programmed for re-syncing and deliver an output to the RGB ANA1 digital bus and to the transmitter DVI chipset for loop through purposes. The same transmitter chip set also can receive the DVI signal from the PMP board via a buffer.

In case of a PanelLink input, the resolution of the projector's display device must match the resolution of the graphics card of the PC. This means that the native resolution of the DMD panel of the projector must be communicated to the graphics card (or scaler) through the DVI connector. This information is stored and is available in an E²PROM on the Input Selector 1. The DVI source can access and read this info via a kind of I²C bus. This communication link is called Display Data Channel (DDC).

This bus can also be switched to the controller I²C bus of the FPGA on the input selector 1 for programming or updating later.

The DVI output has mainly as task to loop through two or three projectors. This DVI output signal can be either the looped DVI input signal, or the processed RGB input signal (processed already by the PMP).

This PannelLink output is a signal that has already been processed and does in theory not need further processing in the PMP of the slaved projector, except for the OSD information.

This means that ALL resolution image processing like edge or contrast enhancement, PIP, etc.., are present in the output signal. However, due to tolerances in the looped projectors some small corrections on black level and gain may be required.

11.3.1.2 Detailed description (see schematics sheet 1/11 to 11/11

11.3.1.2.1 Analog Input and sync processing.

1. Signal selection (sheet 1/11).

The "INTERCONNECTION DIAGRAM" shows a "Power Backplane" (R763426) and an "Input Backplane " (R763378).

The "Power Backplane" is a power interface module for distributing the power from the SMPS to different boards.

The "Input Backplane" is an interface for the signals, receiving the two input selector 1 and 2 signals, the communication Interface and the CPU (I²C bus).

The RGB inputs are correctly terminated with 75 Ohm and the R/G/B_IN1 signals proceed to the ADC Analog to Digital Converter I4 via clamping capacitors. The RED_DEC1, BLUE_DEC1, CHROM_DEC1 and Y/CVBS_DEC1 signals proceed to the digital decoder via connector J3.

2. Sync selection

Sync pulses embedded in video signals can either be applied to the G input (Sync on Green) or to the HS/CS/CV input (composite video with RGB signals at standard 15kHz). The selection happens based upon the lines YS_1_SEL for sync on green and HS/CS_1_SEL for a composite video sync. The user in the installation menu must do this selection. Disturbing video frequencies are filtered out with C3 by switching on Q1.

SOG_IN1 goes to the ADC whereas SYNC_DEC proceeds to the digital decoder for 15kHz component inputs.

1. (*)PanelLink is a trademark of Silicon Image. PanelLink provides a high-speed serial interface that is consistent from VGA through UXGA panel technologies is highly skew and jitter tolerant and can be AC coupled. The standardization of the data mapping according to Digital Visual Interface (DVI) standard makes the interface even more powerful since it allows displays and systems from different manufacturers to inter-operate with each other seamlessly.

3. Sync clamping-restoration (sheet 1/12).

HS/CS and VS sync processing

Most of the sync processing, like HS / VS separation is done inside the ADC chip. Hence, the sync signals just need a little restoration prior to enter them into the AD9888. The negative peak level of the HS and VS pulses are clamped at approximately ground level with one OPAMP in I2 and then put at the right level and amplitude with another OPAMP in I2. As such they can be applied to the AD9888 analog-digital converter.

COAST signal (see sheet 2/11, input pin 53 of I4).

In most computer signals, H sync pulses are provided continuously on a separate wire (separate HS). The sequence of the sync pulses is not interrupted. In some systems however, H sync is disturbed during the V sync period (equalization pulses, Macrovision pulses, …). In other cases they disappear. To avoid upsetting the clock generator it is important to ignore these distortions. The COAST signal, generated on the PMP (AMDS section) is an asynchronous input that disables the PLL input and allows the clock to free-run at its current frequency. The PLL can run several lines without significant drift.

11.3.1.2.2 DVI input (sheet 3/11).

1. Signal flow

The eight RX* signals are routed straight to the SIL161 receiver chip which delivers 3x8x2 bit (three colors, 8-bit and split odd/even pixels). This is the BUS_RX destined for the DVI Re-syncer I12 (see sheet 4/11). This FPGA must deliver the BUS_TX for the DVI OUT and the BUS_TO_INPUT for the multiplexer. This signal is in fact put on the same bus of the RGB_ANA1 output of the ADC (see sheet 5/11). The BUS_TX is converted to the DVI standard with a SIL160.

2. Display resolution info. (DDC lines and Hot Plug detection)

The DVI graphics card in the image generator must generate the DVI signals at the correct native resolution of the display (the projector in this case). The info required by the DVI source is programmed in the I²C controlled E²PROM I7. The moment the source is connected the Hot plug detect line activate the switchers Q3-Q4 such that the DDC Clock and DDC DATA lines are connected to the E³PROM . The DVI source now can read the requested data from this memory. In case of an upgrade of the info, the E²PROM lines can be connected to the CPU I²C bus SCL_PL and SDA_PL with the PL1_WE line.

The E²PROM receives its power supply from the projector or from the DVI source in case the projector is in stand-by or switched OFF.

11.3.1.2.3 Analog to digital converter I4 (AD9888KS).

Description

The pixel clock output frequencies of the AD9888 range from 10 to 205MHz and is compatible with the UXGA resolution (1600x1200@75hz). The ADC generates its own clock based on the HSYNC_1 input or accepts an external clock. RGB or YUV signals are converted into 48 bits (3 colors, 8-bit depth and odd/even split).

The digital decoder outputs are connected in parallel to the ADC outputs. Therefore, when the ADC is active, the decoder outputs must be switched to a three-state level. If the decoder is active, the ADC outputs must be three-state.

Finally, the power supply is delivered by an external regulator I20, taking its input from the +5V power line.

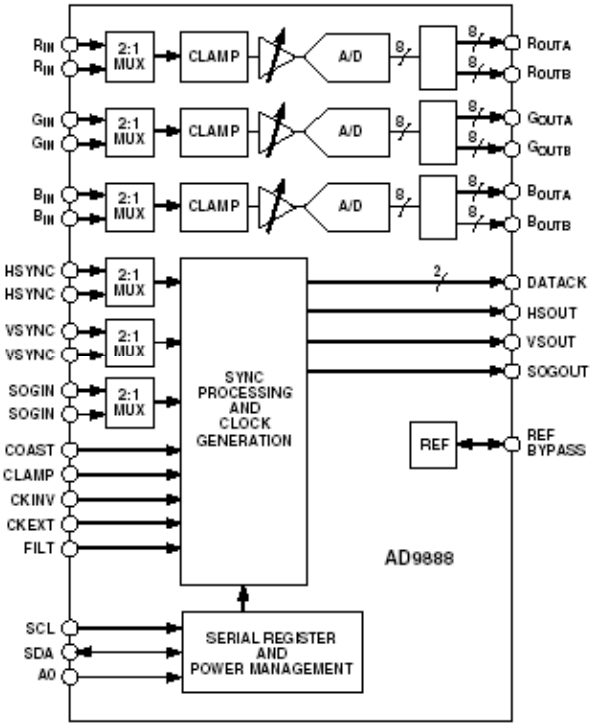


Image 11-3
Block diagram AD9888

Output of the ADC is an RGB 48 bit digital signal. Each color is 2x8bit (odd and even). The split in odd and even is done to lower the clock (clock is half by the odd/even split).

11.3.1.2.4 DVI Output (see sheet 3/11).

Description

The SIL 160 uses Panellink technology to support displays ranging from VGA to UXGA (25 to 165MHz). The BUS_TX signal can be either the DVI IN signal that has been re-synced, or, the processed analog input ([Active Image] in the Input Slot Selection menu).

Note that an analog RGB signal, that has been processed by the PMP has undergone some delay. The DVI OUT signal is not synchronized with the input signal and with the image shown on the projector. It is advised then to install a minimum delay in the" advanced settings" in the "installation menu" (see owner's manual).

11.3.1.2.5 Data multiplexing (see sheet 7- 8/11)

Description

We have four 48-bit digital signals:

- 48 bit from the fixed input selector 1
- 48 bit from the fixed input selector 2
- 48 bit from the optional digital input 1
- 48 bit from the optional digital input 2

The multiplexing of the four 48 bit RGB signals is done by two FPGA's: I23 for the odd pixels and I24 for the even pixels.

The two FPGA's have almost the same programming done by a third FPGA I25.

One of the four input channels is clocked to the output channel 1(XI1) depending on the level of the signals SLOTSEL0_XI1 and SLOTSEL1_XI1. The same story goes for the second output channel XI2 depending on SLOTSEL0_XI2 and SLOTSEL1_XI2.

For Picture in Picture (PIP) applications, there are two full outputs to the PMP. The latter is also designed to accept and process simultaneously two signals

11.3.1.2.6 Sync switching and control, I25 (sheet 9/11)

Description

The input boards are controlled by the third FPGA (I25). The FPGA is programmed by the projector's microcontroller at start up. The FPGA controller I25 performs following tasks:

- It converts the parallel programming data from the controller into a serial bit stream for the two multiplexing FPGA's I23/I24.
- It allows the controller to set the control signals of the modules Input Selector 1 and Input Selector 2 by writing to certain registers. Also the control lines that determine which input goes to which output channel is set by this controller FPGA according to the controller's data.
- It allows the controller to read the status of the detection signals of input selector 1 and 2.
- It multiplexes the sync signals from the four inputs to the two output channels. It also multiplexes the two COAST and CKINV signals from the PMP channels to the four inputs.
- It buffers the data- and address bus and the control signals that go to the two digital inputs.
- It has an I²C interface that converts the 8 bit parallel data into an I²C bitstream in order to (re)program the E²PROM on the DVI inputs.

11.3.1.2.7 Power section.

Description

Following voltages are generated locally from the +15V on the Input board itself:

- a +12V with I27
- a -12V with the switcher regulator I28
- a +5V with the power converter step down regulator I30

The heavily loaded +3.3V supply rail is sensed on the board and the present voltage sent to the SMPS in order to be sure that the +3.3V supply does not drop too low

11.3.2 Technical Description Input Selector 2

11.3.2.1 General Description

General Description

The input selector II is very similar to the Input Selector I except that this one has a DVI Input but no DVI output.

This input also has a 5-cable configurable input and one DVI (PanelLink*) input.

The input signals are converted into a 48-bit (3x2x8) digital RGB format which go to Input Selector I for multiplexing to the input channels of the PMP.

Besides signal processing, the board also handles the sync processing and multiplexing (=selection) of the sync for the AMDS (source identification) on the PMP.

The 5-cable input can handle all possible analog input signals: RGBHV, RGBCS, RGBCV, RGsB, YUVCS, YsUV, video and S-video.

The RGB and YUV signals are applied to an Analog Digital Converter, same type as on Input 1.

The video and S-video signals are routed to a digital decoder and its output is added in parallel to the RGB digital bus (three-state technology).

The PanelLink* or DVI input allows a direct digital interfacing with a DVI output of a PC or other devices equipped with DVI outputs, such as scalers.

The PanelLink* ([1])signals are also processed by a SIL 161

The I8 contains all information required by the DVI source to adapt the resolution.

11.3.2.2 Analog input and sync processing

Description

This section is almost identical to the Input Selection 1 and we refer to this paragraph for a detailed explanation.

11.3.2.3 DVI Input

Description

The DVI input is identical to the DVI Input as described for the Input Selection board 1and is also based upon the SIL161 from Silicon Image.

11.4 Power Supply

11.4.1 Power Diagram for Input Selection module 1

Schematic

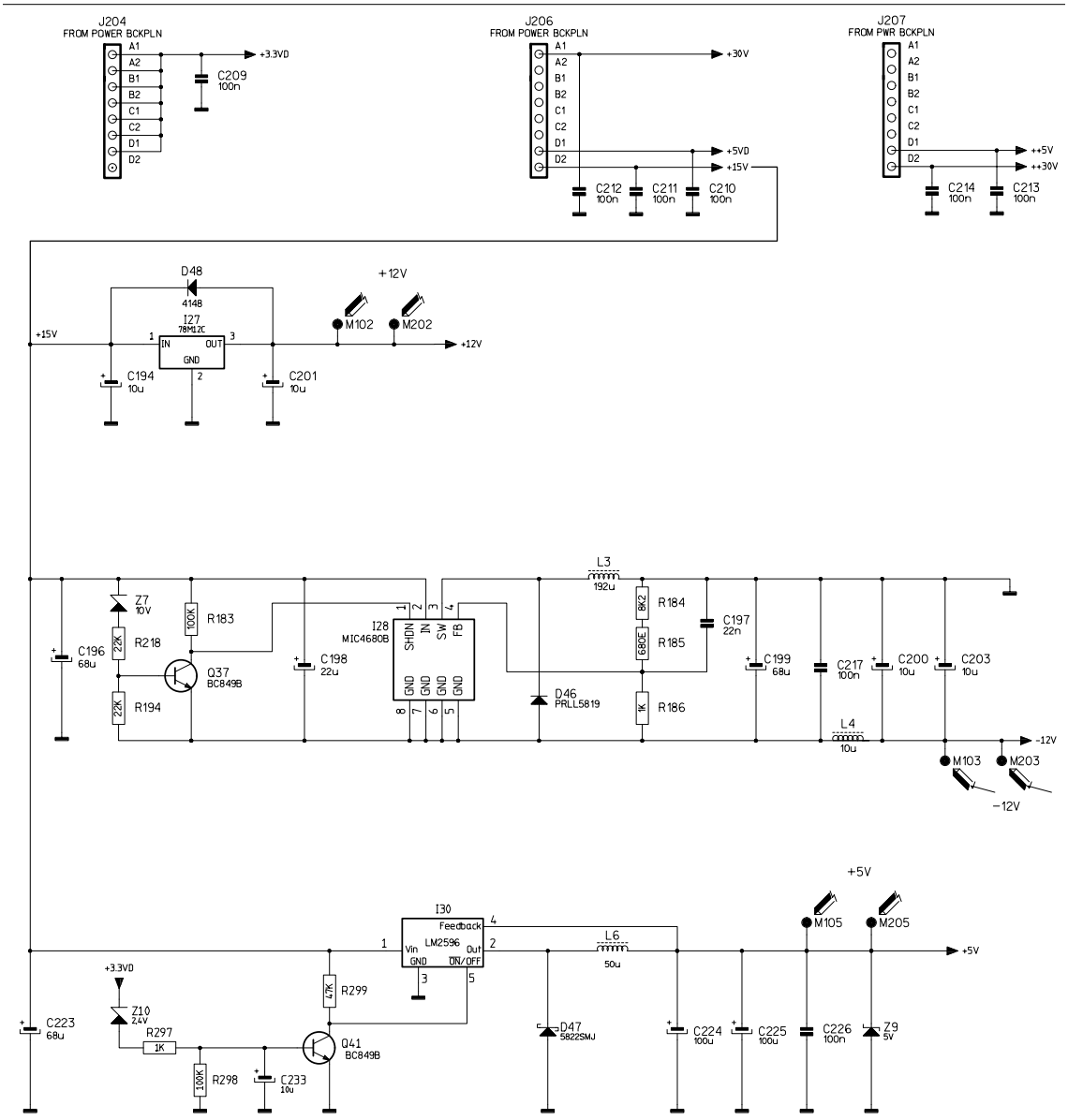


Image 11-4
Power diagram (part 1)

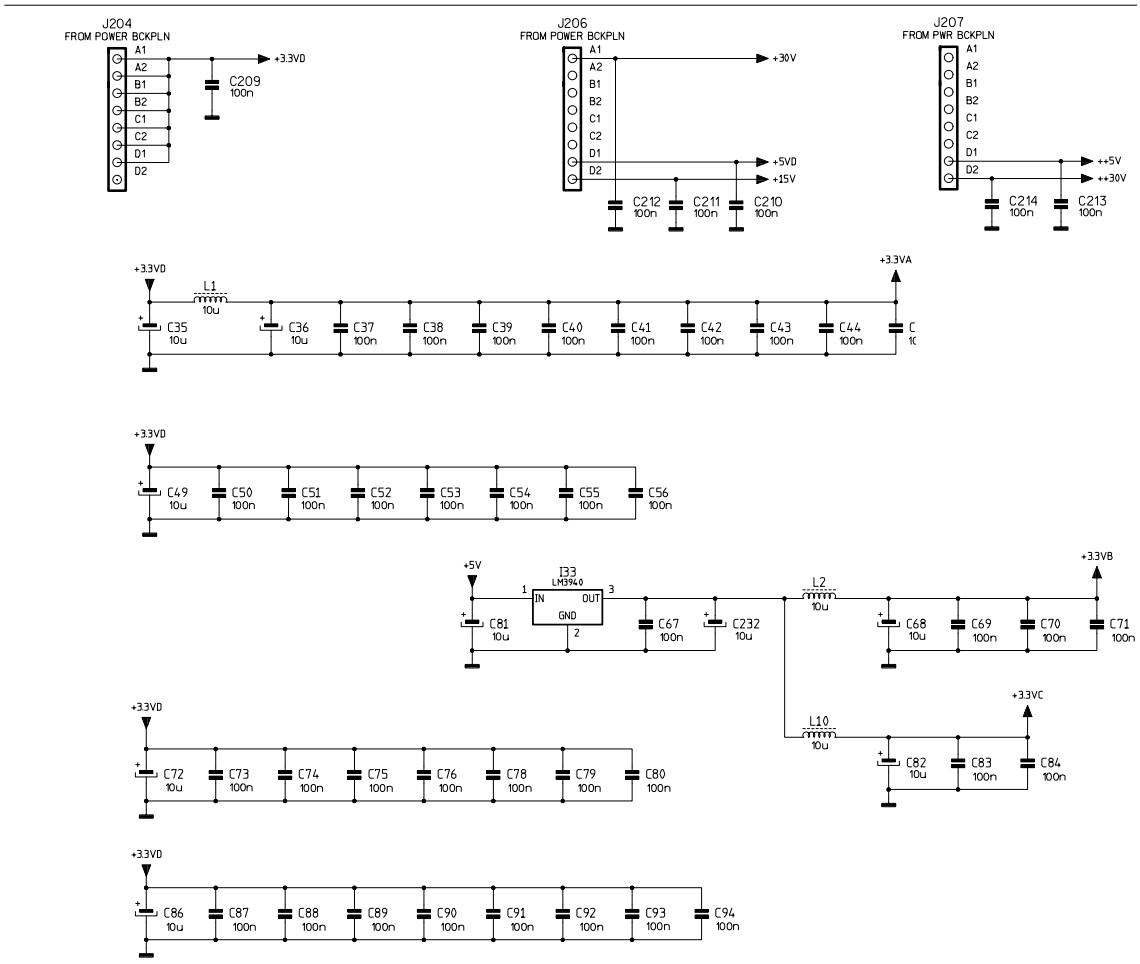


Image 11-5
Power diagram (part 2)

Location Components on board

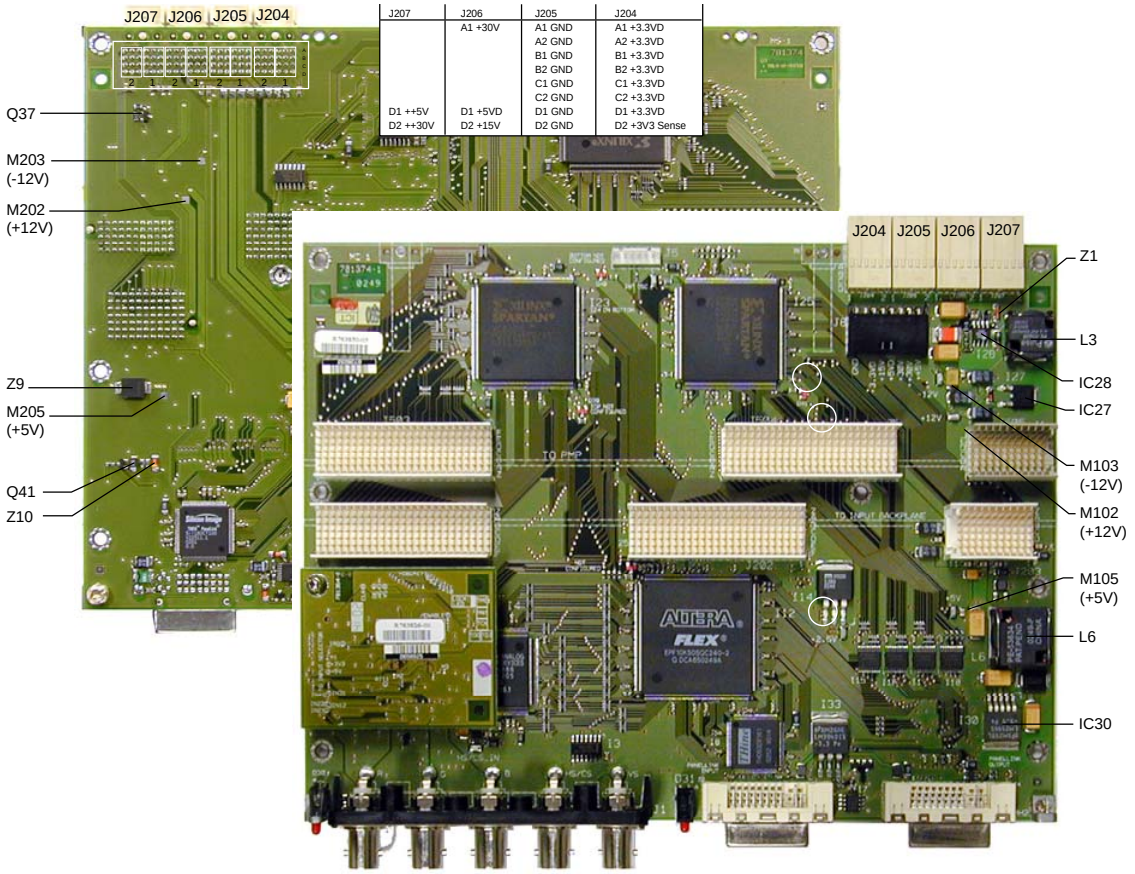


Image 11-6
Power supply (location components)

11.4.2 Power Diagram for Input Selection module 2

Schematic

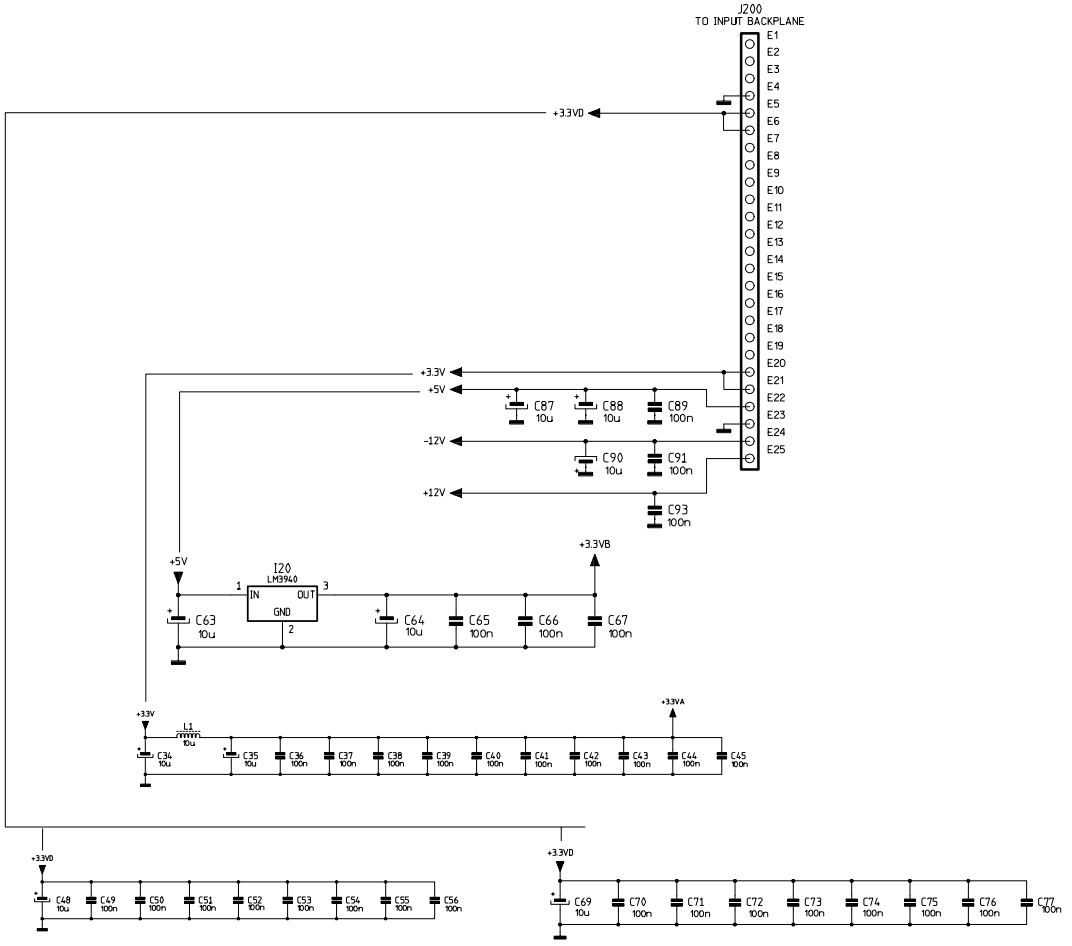
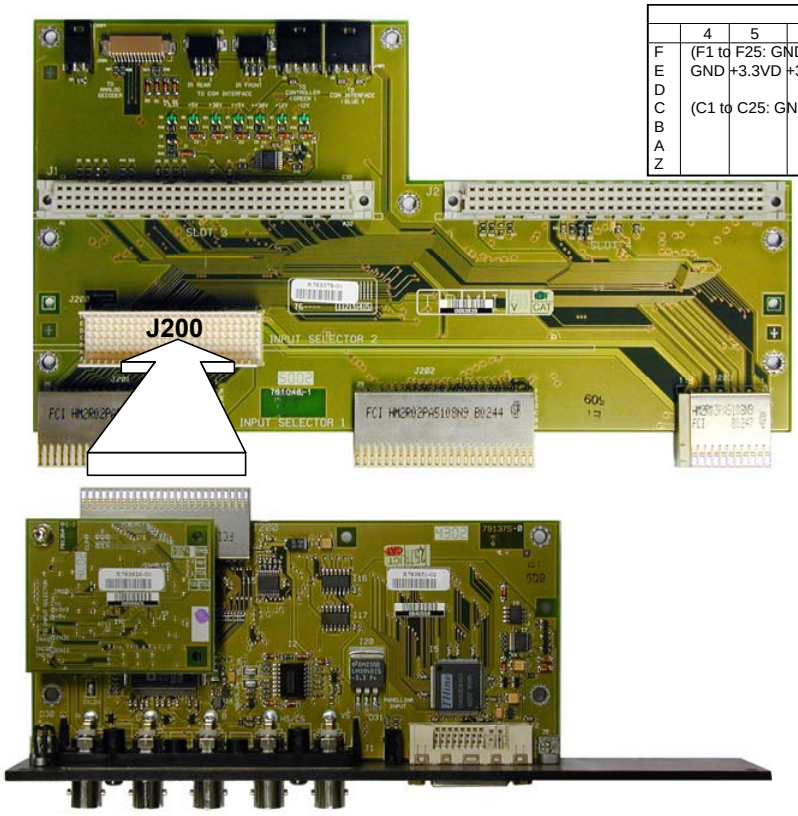


Image 11-7
Power diagram

Location Components on board



	J200								
	4	5	6	20	21	22	23	24	25
F	(F1 to F25: GND)								
E	GND	+3.3VD	+3.3VD	+3.3VD	+3.3VD	+5V	GND	-12V	+12V
D									
C	(C1 to C25: GND)								
B									
A									
Z									

Image 11-8
Power supply (location components)

12. DIGITAL DECODER R763826

12.1 General Info

Introduction

This decoder board is connected to the Input Selection 1 and 2 boards and accepts video (CVBS), S-video (Y/C) and component signals. These signals are entered via the programmable 5-cable BNC inputs. It is obvious that either a computer RGB signal or a video signal can be selected. The SAA7118E is a multi-standard video decoder chip with additional component processing providing an optionally scaled video output. The circuit is fully I²C-bus controlled.

View of the Digital Decoder

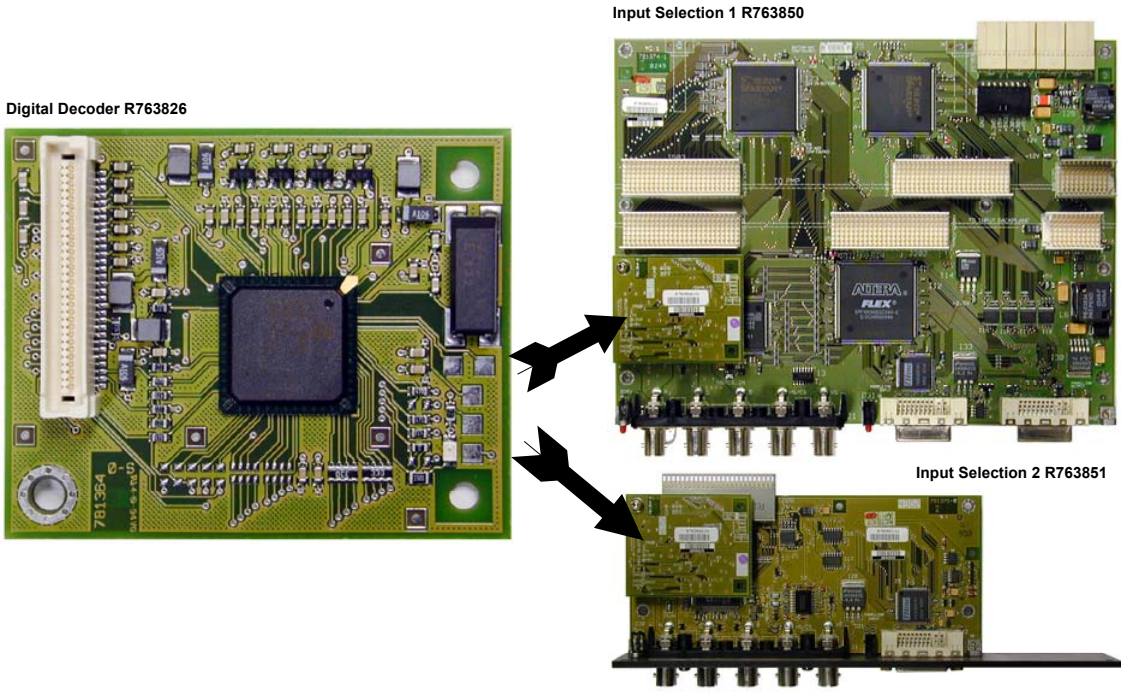


Image 12-1
Digital decoder

12.2 Block Diagram Digital Decoder

Block diagram

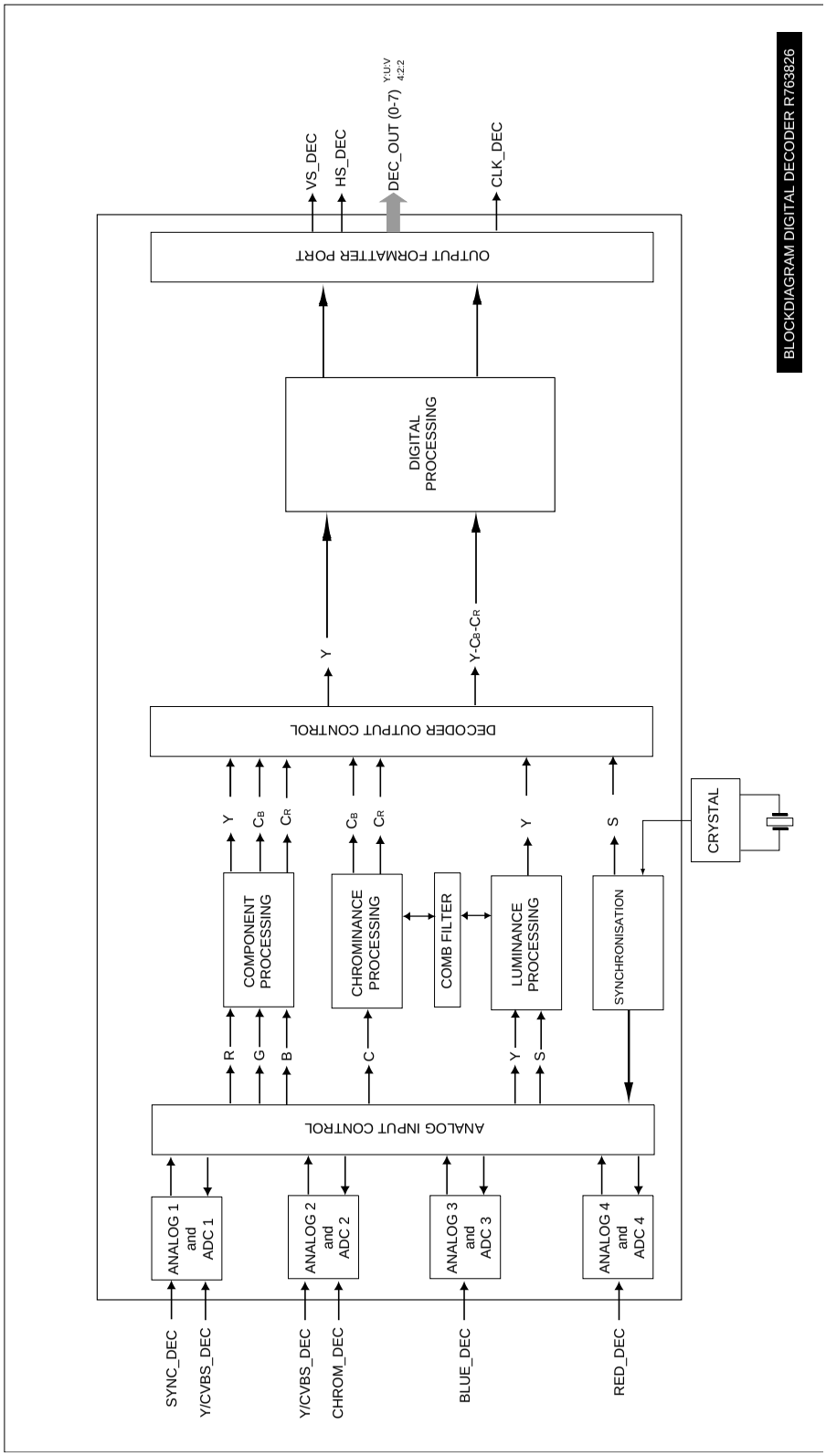


Image 12-2
Block diagram Digital decoder

12.3 Technical Description

12.3.1 General

Introduction

This decoder board is connected to the Input Selection 1 and 2 boards and accepts video (CVBS), S-video (Y/C) and component signals. These signals are entered via the programmable 5-cable BNC inputs. It is obvious that either a computer RGB signal or a video signal can be selected. The SAA7118E is a multi-standard video decoder chip with additional component processing providing an optionally scaled video output. The circuit is fully I²C-bus controlled.

12.3.2 Functional Description

Analog input section

The SAA7118E has sixteen analog inputs, four analog main channels with source switching, a clamp circuit, an analog amplifier, alias-filter and finally a 9-bit CMOS Analog to Digital Converter.

The clamp control circuit controls the clamping to the correct levels for the ADC's. The coupling capacitor is used to store and filter the clamping voltage.

The gain control circuit receives the static gain levels via I²C or the gain is adjusted via a built-in AGC. The AGC active time is the sync bottom of the video signal.

Components are manually adjusted. Signal peal control limits the gain at signal overshoots.

During the vertical blanking period, gain and clamping controls are frozen to avoid influences of digital data and anti-copy encoded signals.

The alias filter has a roll-off starting at about 6 MHz and -30dB at 12Mhz.

Chrominance path.

The 9-bit CVBS or Chrominance input is supplied to the input of a quadrature demodulator. Two time multiplexed (0° and 90° phase relationship to the demodulator axis) are therefor generated by the SUBCARRIER GENERATION 1 block. The (time multiplexed) output signals are then passing a low pass filter to achieve the desired bandwidth.

The filtered signals are now fed to an Adaptive Comb Filter where the chrominance signals are separated from the luminance. This block is bypassed for Secam and during the Vertical Blanking Interval (VBI). A second low pass filter allows to shape the bandwidth of the chrominance without affecting the luminance.

SECAM signals are processed by the SECAM PROCESSING block and it is bypassed for quadrature modulated signals.

Next is a "Chroma gain control" section amplifying or attenuating the signals according to the detected burst amplitude in the "Burst Processing" block. This block achieves following tasks:

- burst gating
- color identification and color killing
- comparison nominal / actual burst amplitude
- loop filter chrominance gain control
- loop filter chrominance PLL
- PAL/SECAM sequence detection, generation of H/2 signal

The output of this block is used to generate a stable phase-locked sine signal under all conditions.

The PAL DELAY LINE block eliminates crosstalk between the chrominance channels. The embedded line delay is also used for Secam recombination with the help of the fH/2 switch signal.

The CB-CR signals are now fed to the last decoder output control block, the "brightness / contrast / saturation control" block.

Luminance path.

The rejection of the chrominance components within the 9-bit CVBS is achieved by subtracting the re-modulated chrominance from the CVBS input.

The comb filtered CR-CB are interpolated (upsampled) and then multiplied by two time multiplexed subcarrier signals. Because the component at the adaptive comb filter output are delayed, these time multiplexed oscillator signals must also be delayed with a time dependent on the color system and the comb filter setting. The re-modulated CR and CB signals are then added to build the re-modulated chrominance (CHR) signal, ready for substraction.

In the last block, the separated luminance can be modified by applying a peaking or resolution enhancement . This peaking can be fixed value or user controllable.

Matrix - Down Formatter - Multiplexing.

A matrix converts the RGB signals from the analog-to-digital converters to the Y-CB-CR format. Component input signals are by-passed after delay compensation.

The colour difference signals are first passing a low-pass filter, and then mutliplexed according the ITU standard. The Y, on the other hand, passes a high pass filter and then a delay compensation.

In a last stage, a multiplexer “selects” the decoder output or the R/R-Y, G/Y or B/B-Y matrixed signals.

Digital processing - Scaling.

The digital processing consists of an acquisition control, pre-scaler for horizontal down-scaling, line buffer with asynchronous read and write for vertical up-scaling, a vertical scaling section and output formatter.

The video scaler receives its input from the video decoder or from the expansion port (X-port, and not used here).It gets 16-bit Y-CR-CB 4:2:2 input data at a continuous rate of 13.5MHz. It is sorted into a luminance path and time multiplexed chrominance path. If it is a 4 : 1 : 1 format it is converted to 4:2:2 first.

The 8-bit Y-CR-CB output from the decoder, real time and unscaled ,is available at the bi-directional expansion port (X-port) from where it is sent to the PMP board via the connector J3.

12.3.3 Power Supply

Power diagram for Digital decoder

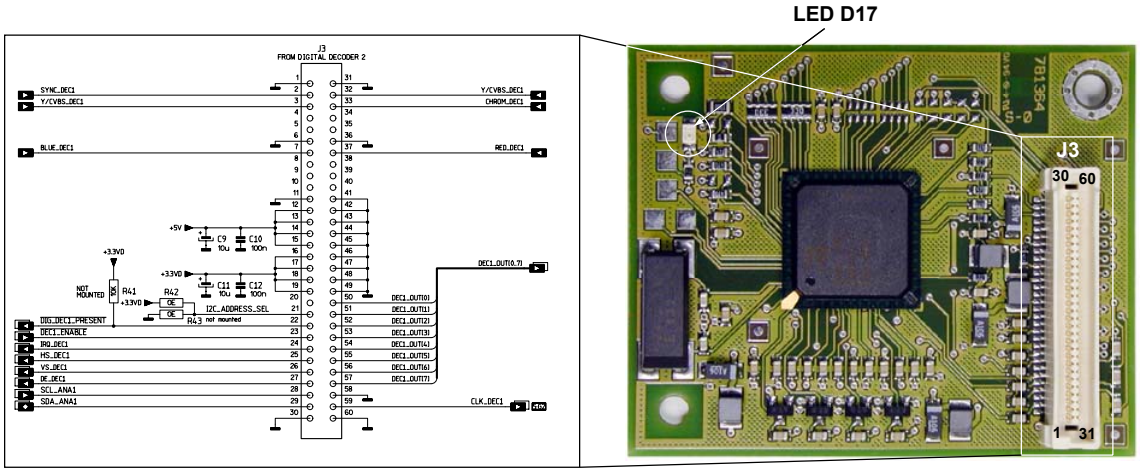


Image 12-3
Power Supply for Digital decoder

GREEN LED D17: illuminates when the decoder is locked (Vertical & Horizontal lock and Colour detected)

Power Supply test points

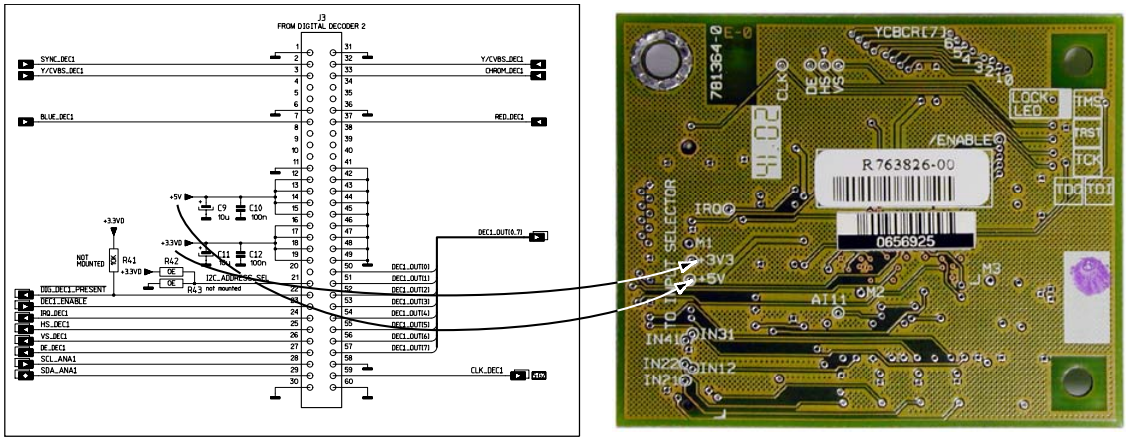


Image 12-4
Power supply measurement points

13. DIGITAL INPUTS BACKPLANE R763378

13.1 General Info

Introduction

This module connects Input Selector 2 (R763851) and the two Digital Input slots with Input Selector 1 (R763850). It also gives power to the Controller (R7638858) and the Communication Interface (R763766). It receives the standby I²C signals from the Controller and routes them through Input Selector 1 to the Power Backplane (R764239). These signals are used by the Switched Mode Power Supply (R764349). The IR signals from the front and rear IR receivers are routed from the Power Backplane, through Input Selector 1 to the Communication Interface. The power supply voltages can also be monitored on this board through led's D5 to D11.

View of the Digital Inputs Backplane

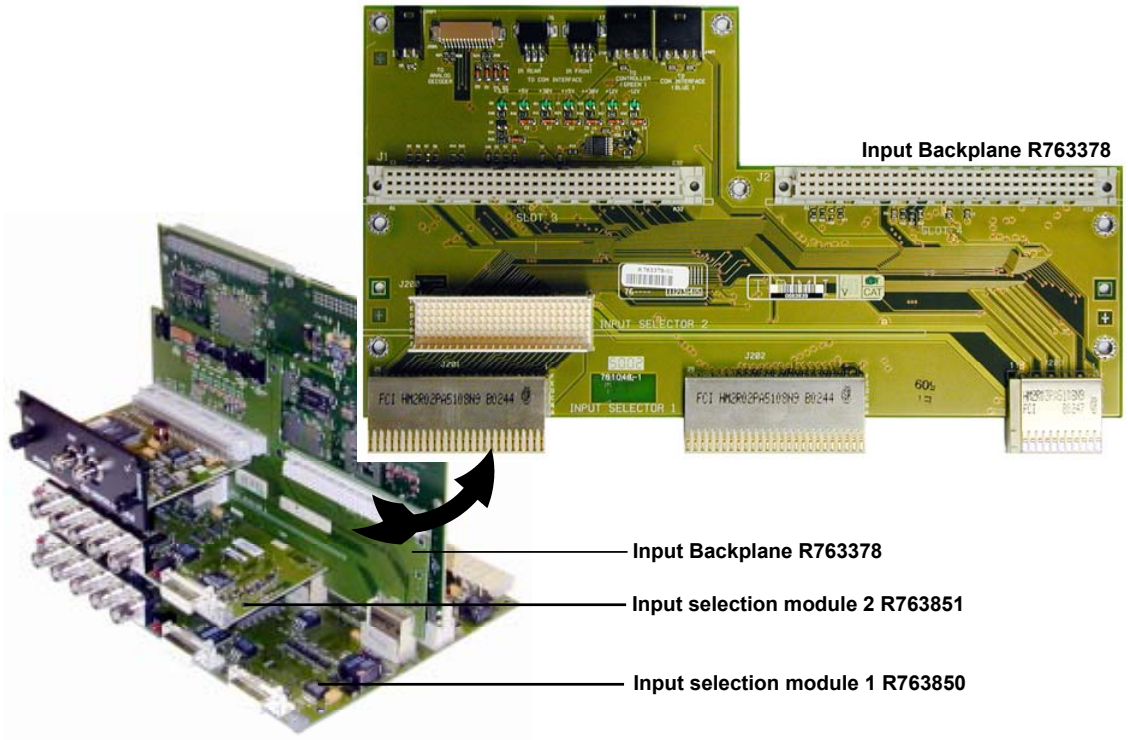


Image 13-1
View Digital Input Backplane

13.2 Power Supply Monitoring

Power supply voltages monitoring

The available generated power voltages are monitored by a specific Green LED on the digital input backplane. To view the LEDs, remove the SDI input module.

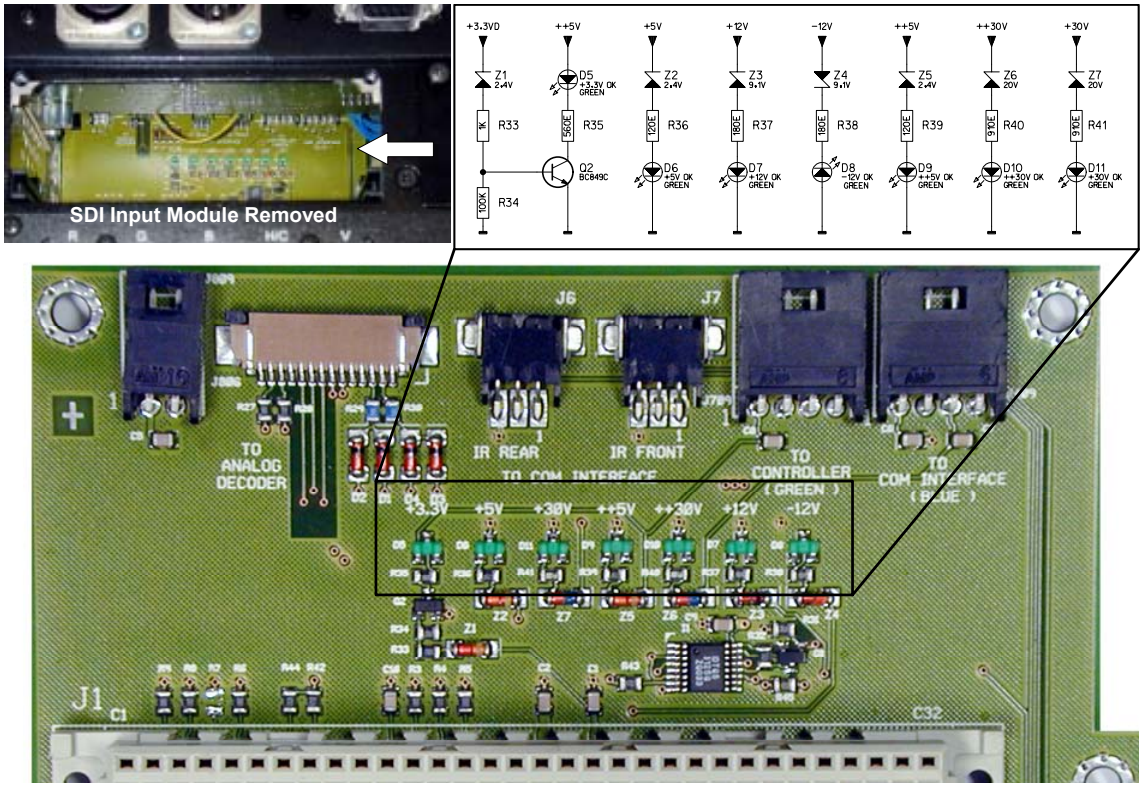


Image 13-2
Power Supply Voltage monitoring

13.3 Interconnection with Communication Interface

Interconnection diagram

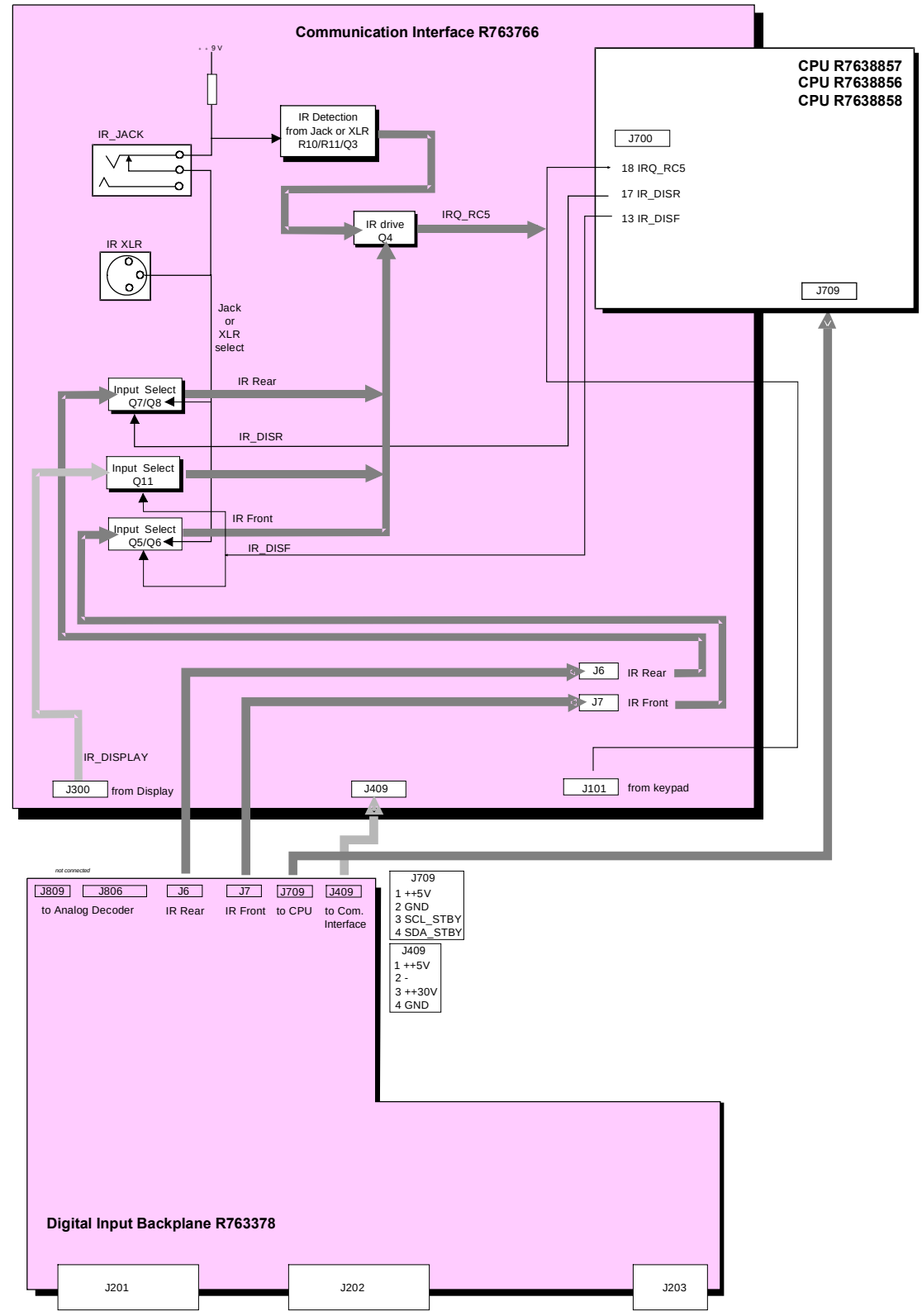


Image 13-3
Interconnection diagram with Communication Interface

14. POWER DISTRIBUTION BACKPLANE R764239

14.1 General Info

View of the Power Distribution Backplane

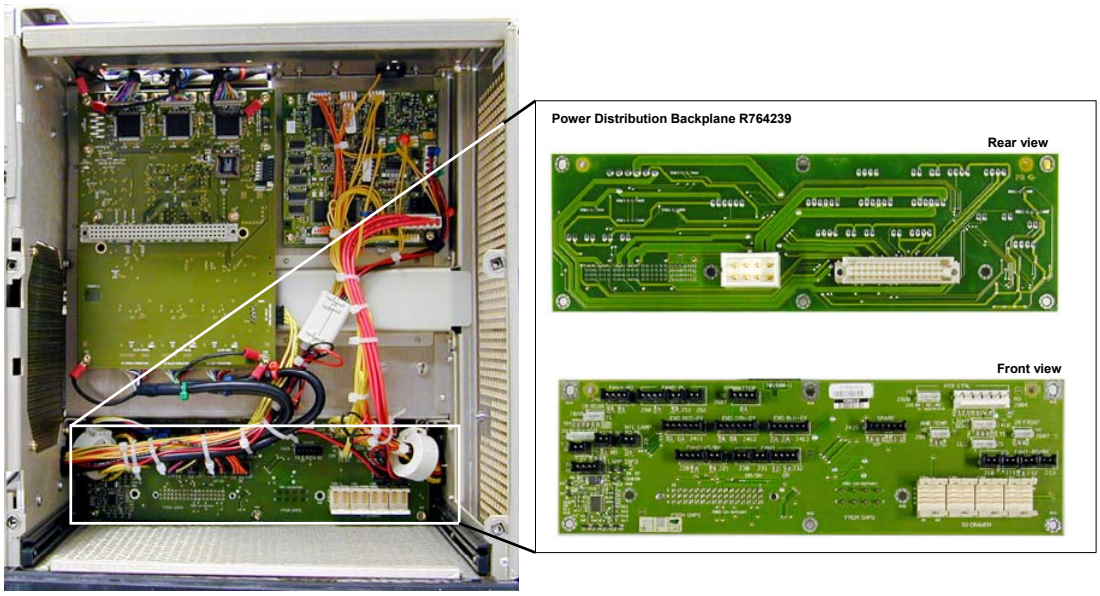


Image 14-1
View of the Power distribution backplane

Short description

The Power distribution backplane routes through the different logical signals and provides power to the respective modules (Mounted in the Electronic Box). The Power distribution backplane is on one side connected to the SMPS via a 8-pins and a 48-pins Euro connector and on the other side connected to the Electronic Box via four 8-pins Euro connectors.

Via wire units, plugged in on the rear of the backplane, power is supplied to the temperature & motor control module and the different FANs in the projector.

A quad bi-directional translating switch, controlled via the I2C -bus, ensure correct data communication to Lamp Info module, Temp. & Motor control and Tilt switch.

14.2 Pin Assignment Connectors on Board

14.2.1 Euro-Connectors

Euro-Connector Rear Side Backplane

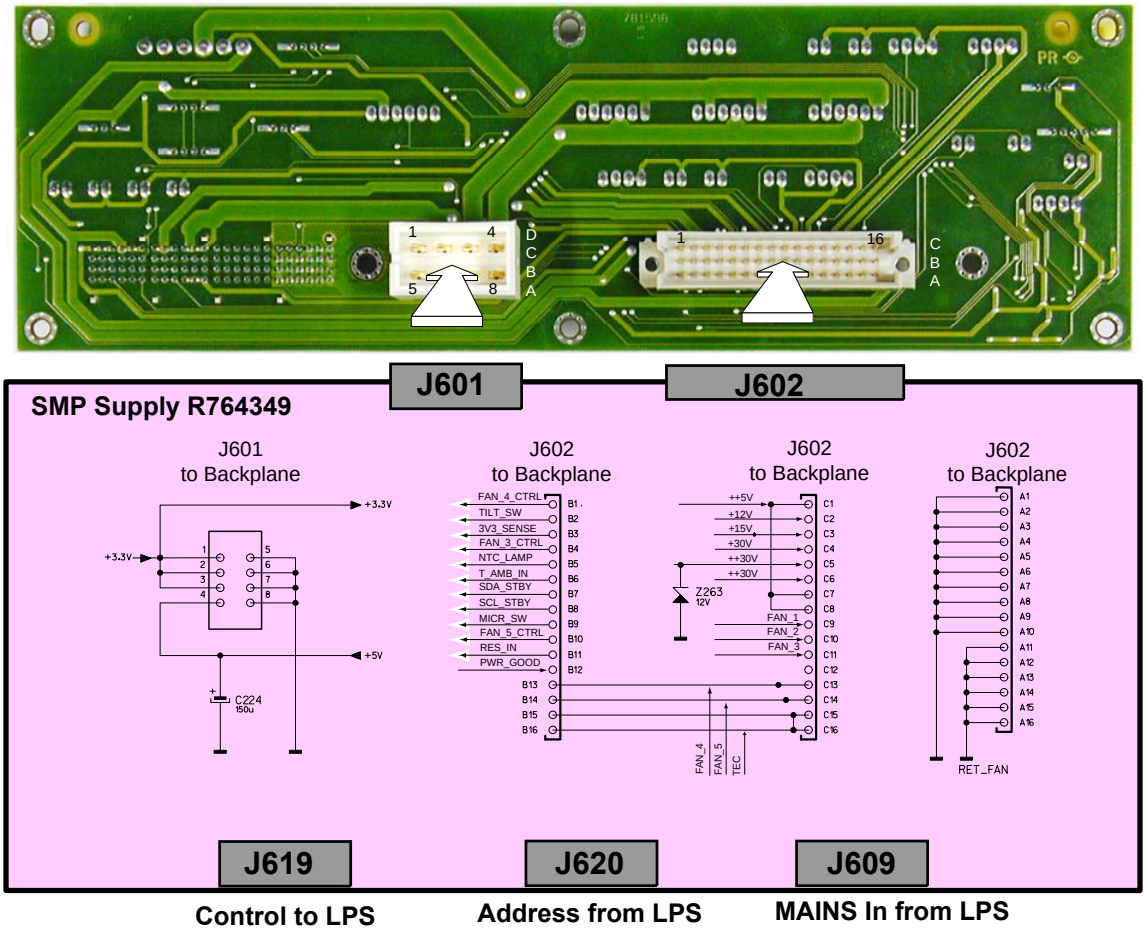


Image 14-2
Interconnection with SMPS

Euro-Connector Front Side Backplane

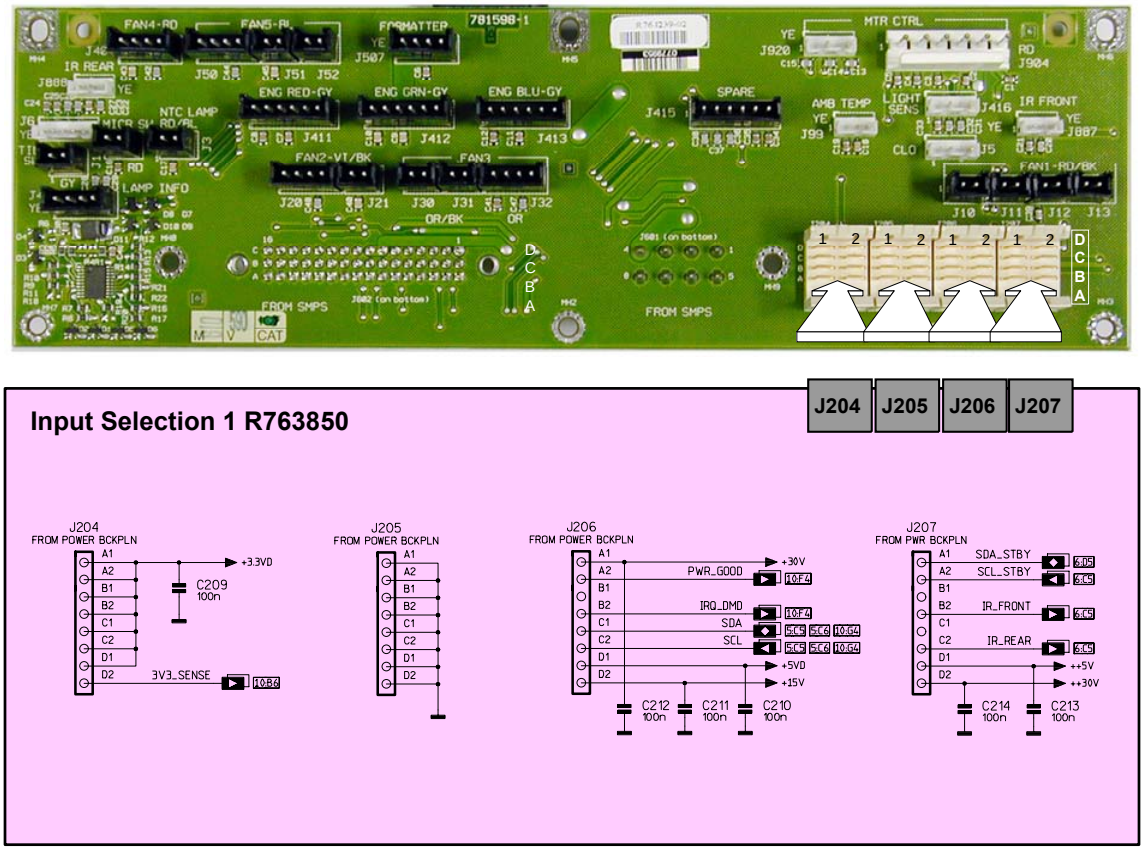


Image 14-3
Interconnection with Input selection 1/2

14.2.2 Wire-Connections

Not used wire-connections

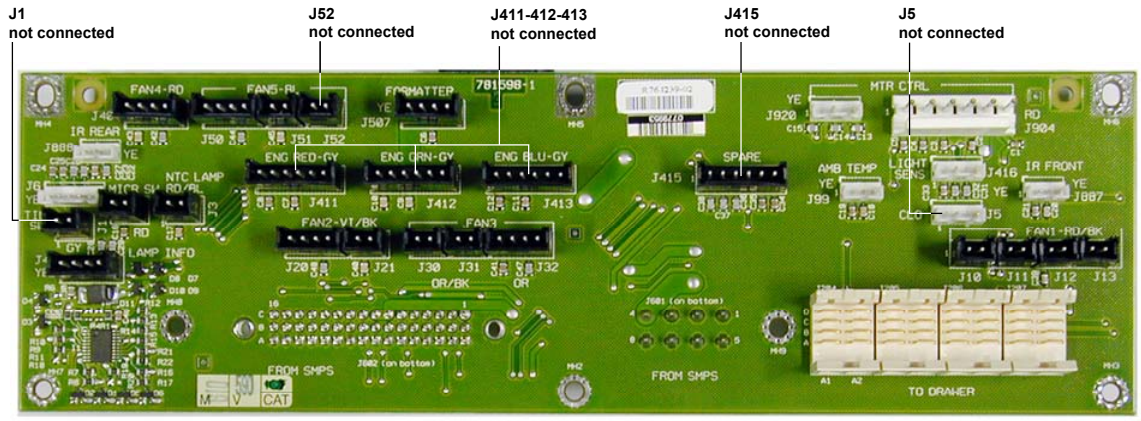


Image 14-4
Not used wire-connections

14.2.2.1 Wire-connections to FANs

Interconnection FAN Group_1

Color of the wires of the connection cable is Red/Black

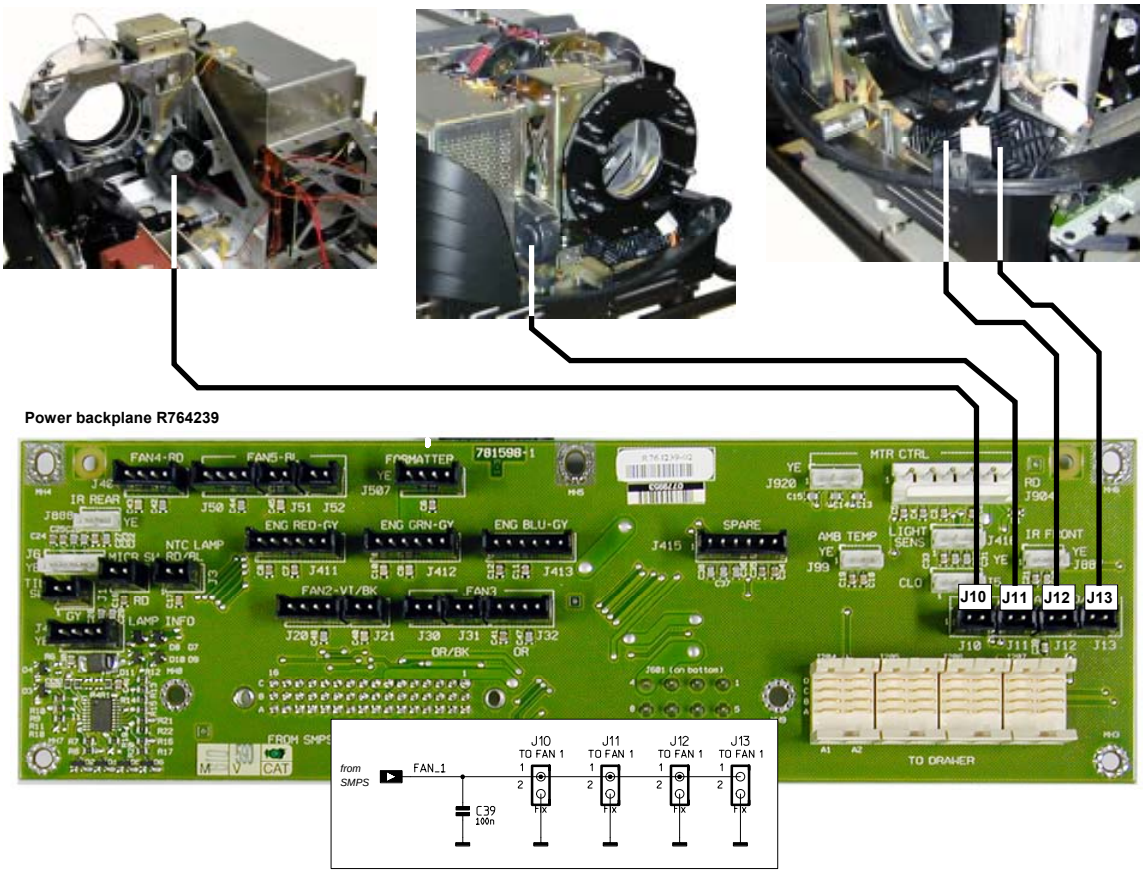


Image 14-5
Interconnection FAN Group 1

Interconnection FAN Group_2

Color of the wires of the connection cable is Violet/Black

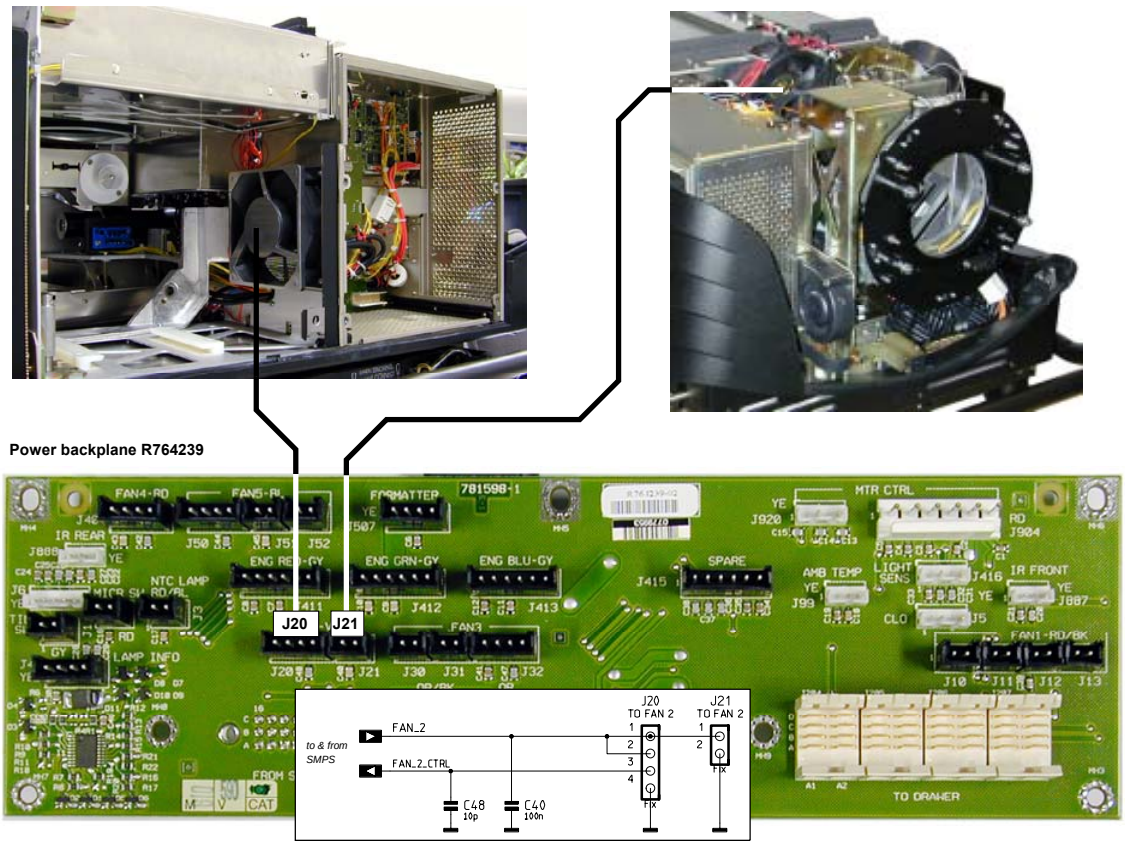


Image 14-6
Interconnection FAN Group_2

Interconnection FAN Group_3

Color of the wires of the connection cable is Orange/Black

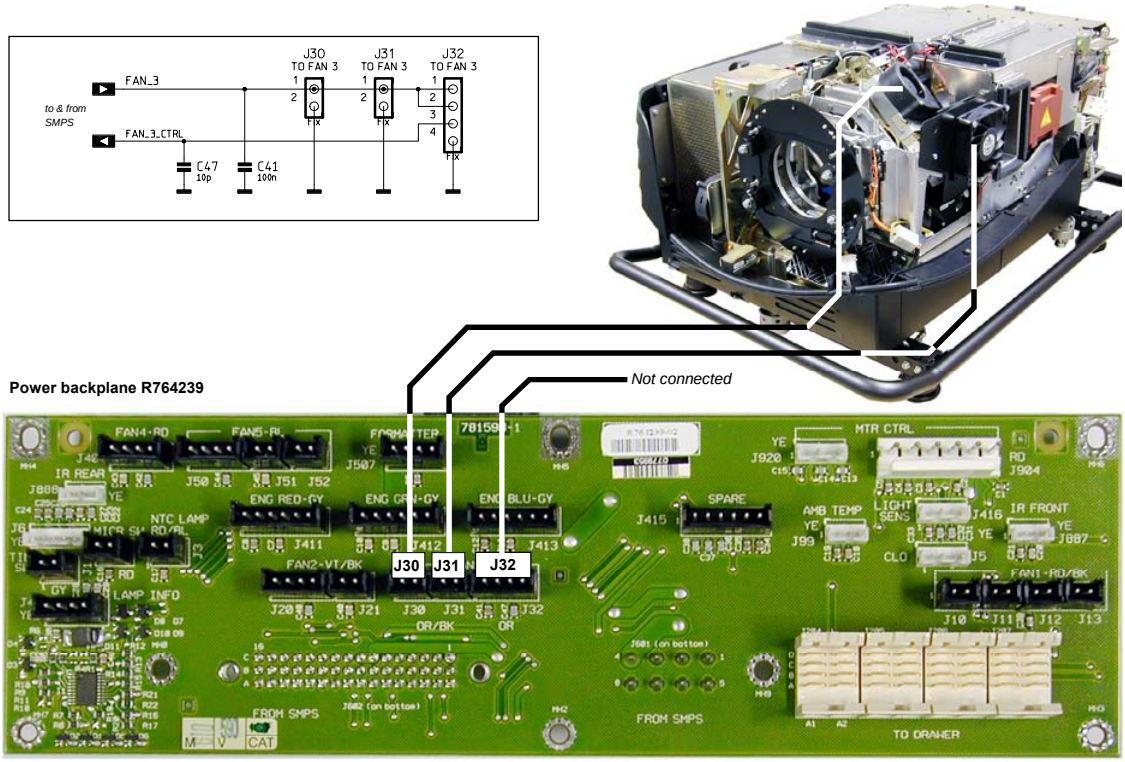


Image 14-7
Interconnection FAN Group_3

Interconnection FAN Group_4

Color of the wires of the connection cable is Red.

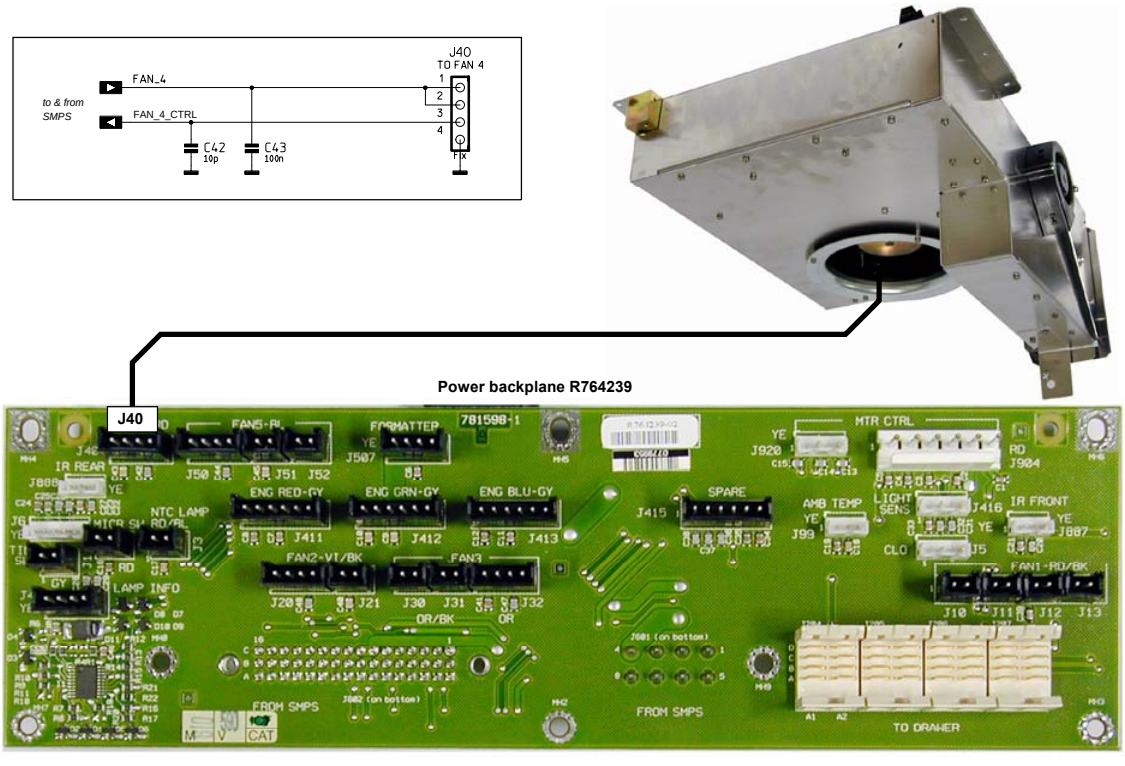


Image 14-8
Interconnection FAN Group_4

Interconnection FAN Group_5

Color of the wires of the connection cable is Blue.

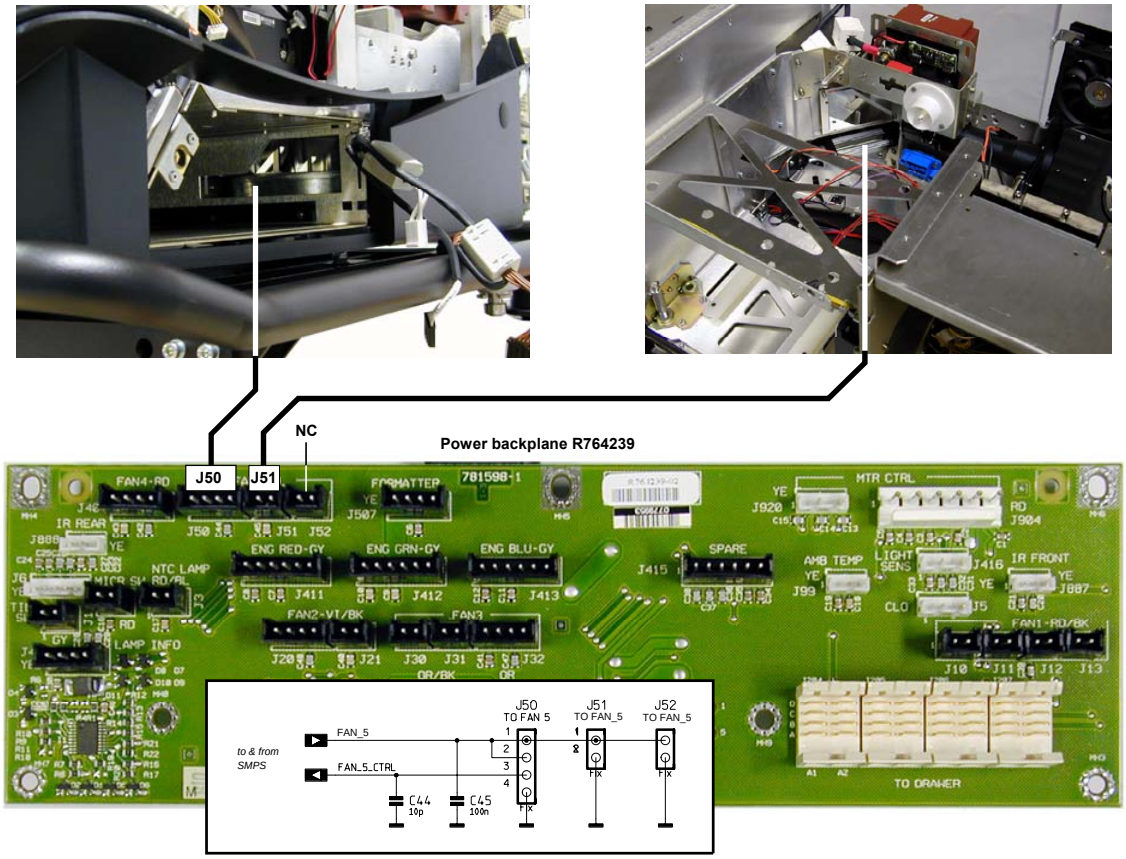


Image 14-9
Interconnection FAN Group_5

14.2.2.2 Wire-connections to Modules

Interconnection with Temperature & Motor Control module

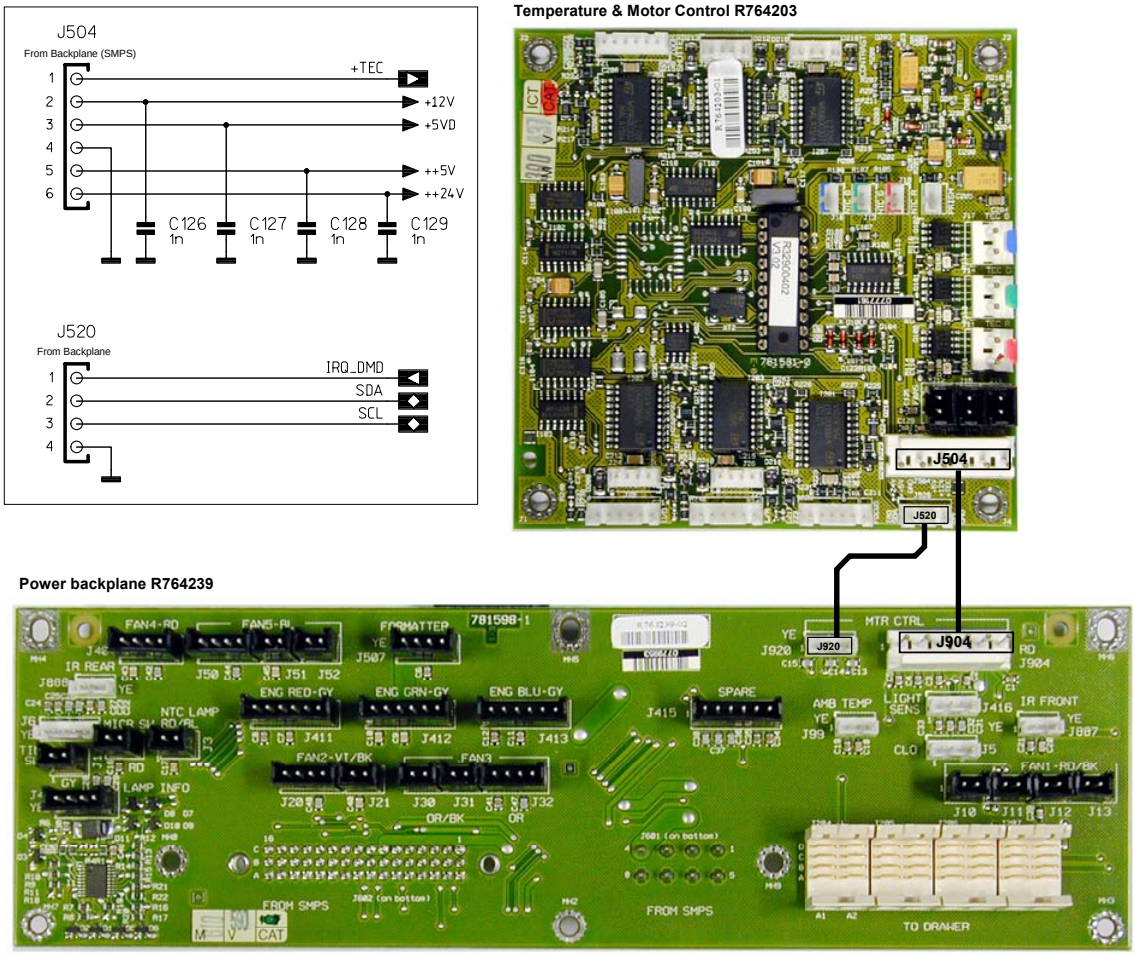


Image 14-10
Interconnection with Temperature and Motor Control module

Interconnection with Formatter Interface module (FIB)

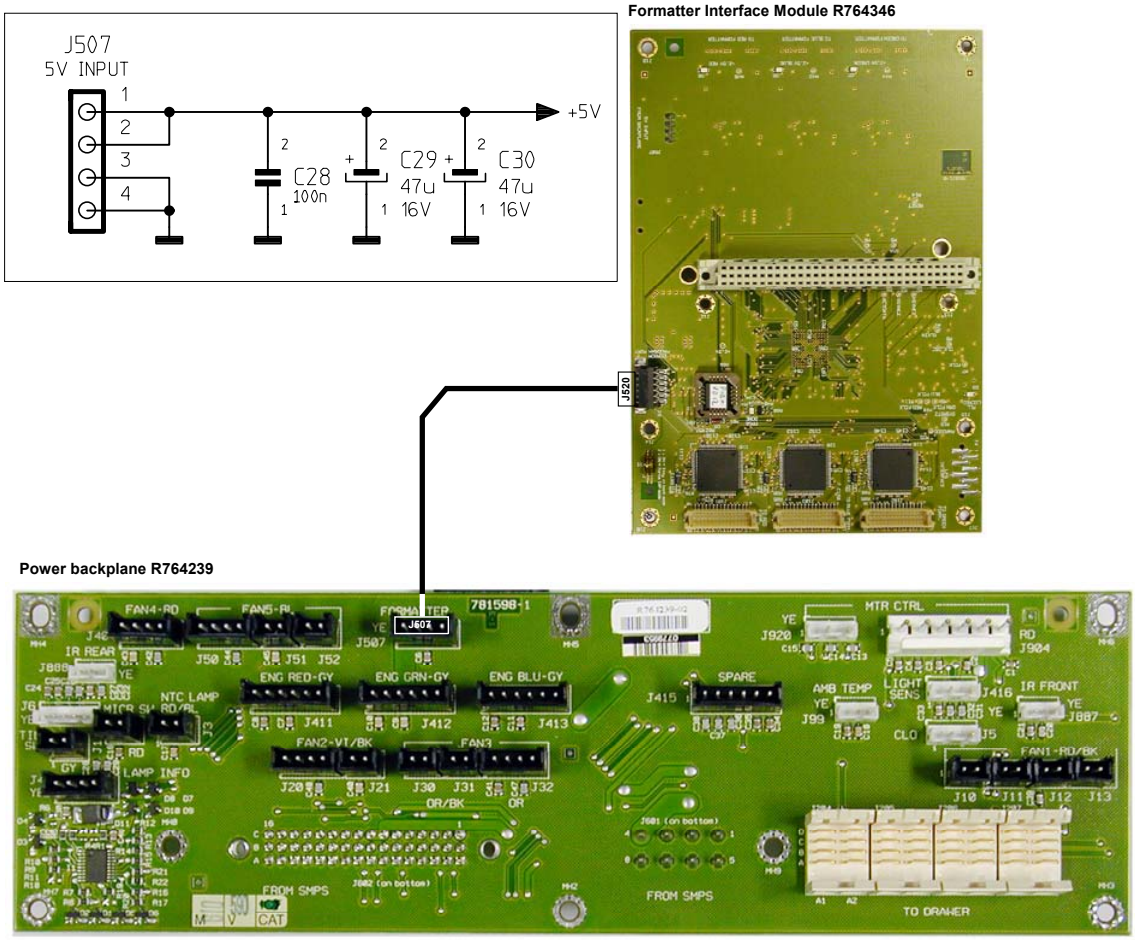


Image 14-11
Interconnection with Formatter Interface module

Interconnection with IR Receivers & Ambient Temp Sensor

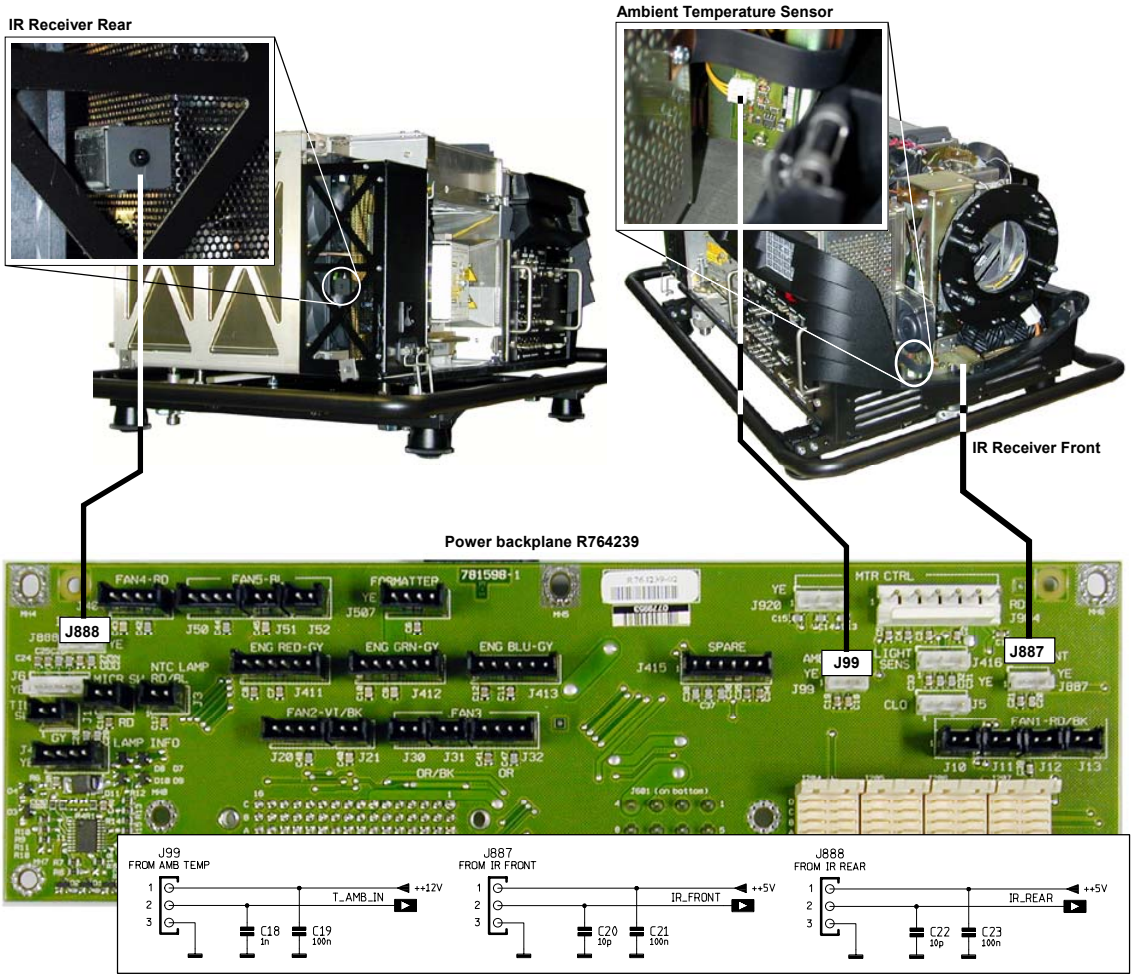


Image 14-12
Interconnection with IR Receivers & Ambient Temp Sensor

Interconnection with Tilt Switch & Lamp Info

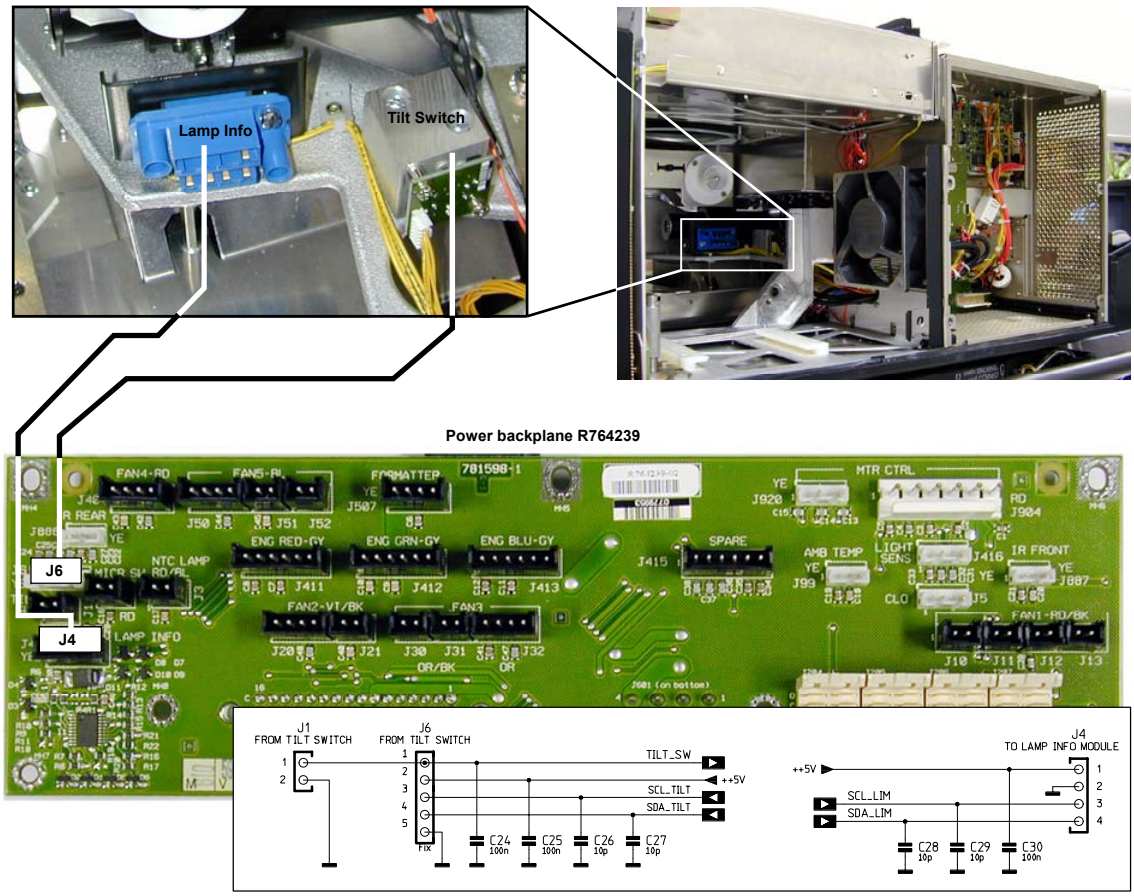


Image 14-13
Interconnection with Tilt Switch & Lamp Info

Interconnection with Micro switch, Light Sensor & Lamp Temp NTC

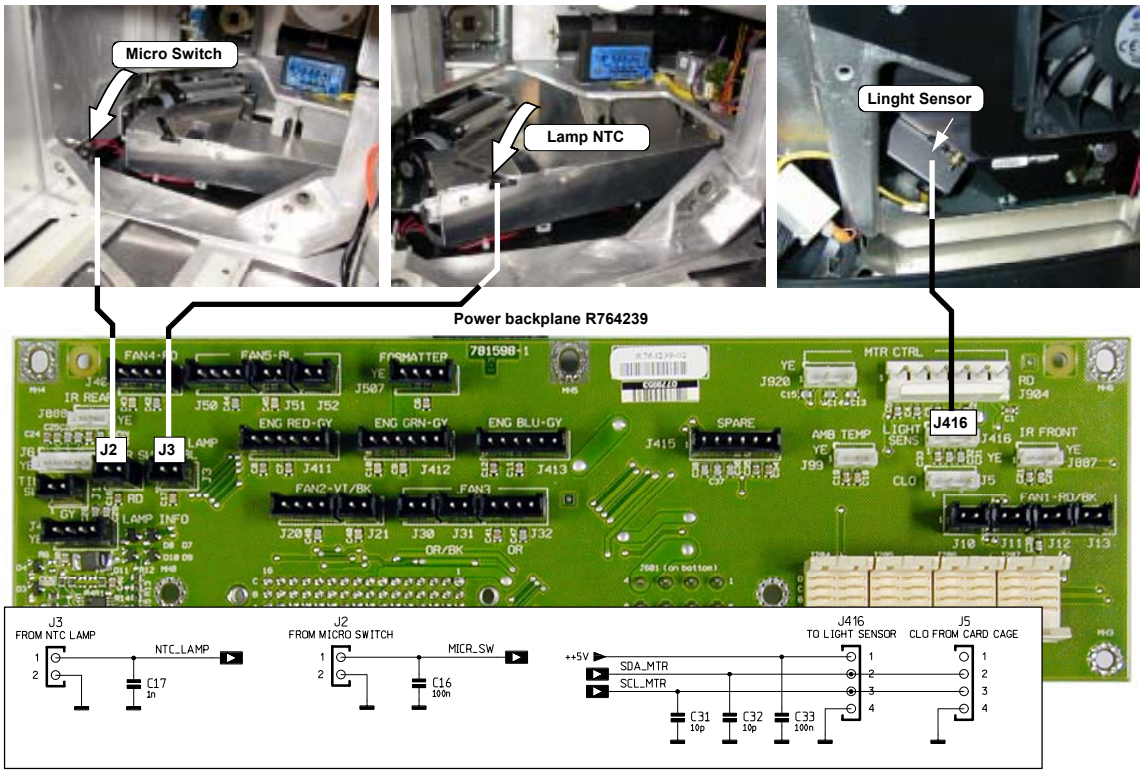


Image 14-14
Interconnection with Micro switch, Light Sensor & Lamp Temp NTC

15. LAMP POWER SUPPLY R7633705

Attention!

WARNING

THIS CIRCUIT BOARD IS HOT TO AC. THIS POWER SUPPLY, DOES NOT USE A LINE ISOLATION TRANSFORMER, MEANING A PORTION OF THE CIRCUITRY IS HOT-TO-LINE AND SHOULD BE TREATED WITH CAUTION.

Also When the mains is switched off, a period of at least 2 minutes must pass before unplugging the module for servicing

Image 15-1

15.1 General Info

View of the LPS

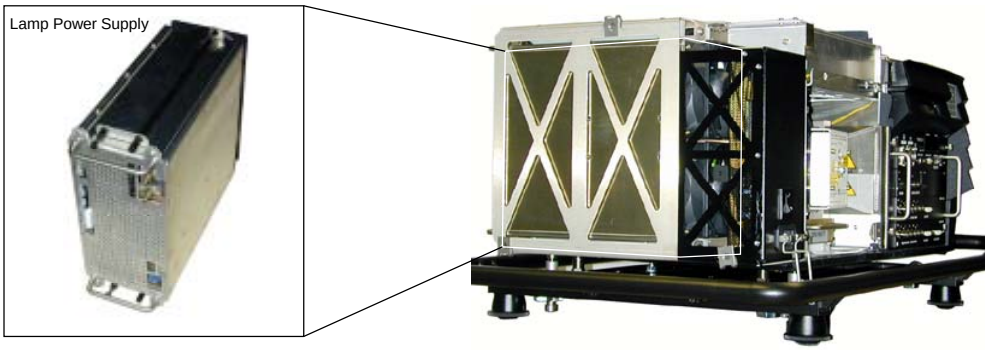


Image 15-2
View of the Lamp Power Supply

Modules of the LPS

The Lamp Power Supply includes the following modules:

LPS assembly ref.	Part No	Description
1	R7633705	Lamp Power Supply Xenon casing /5
2	R7632113	Lamp Power Supply Xenon In/Out /3
3	R7632105	Lamp Power Supply Processor /5

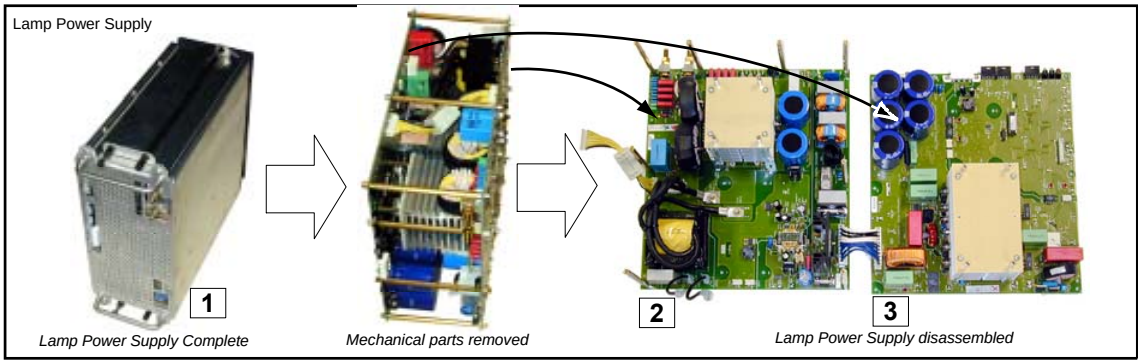


Image 15-3
Modules of the LPS

Order Number for the LPS

Item	Order No
Lamp Power Supply (Complete)	**R7633705K**

15.2 Technical Info

General

This module behaves like an electronic ballast for the lamp of the projector.

The Mains input voltage is either 90 to 264 V AC or 200 to 264V AC and the power delivered to the lamp is adjustable via the I²C bus. The maximum power however is limited to 2500 W and the maximum current, although also adjustable via I²C, is limited to 105 A maximum.

Specifications

Input (two ranges):

Universal range	90V AC to 264 V AC
230V Range only	200 V AC to 264 V AC

Outputs:

Output voltage	11V to 65V at starting up max. 105V.
Output current	100A maximal at starting up 180A maximal
Output power	• adjustable up to 2600 W in 230 V AC range • adjustable up to 1400 W in universal range
Output frequency	DC

Protections

Input current	fused with	T20AH
Input voltage	internal SMPS starts at	Vac > 80 V AC
LPS	starts at	Vac > 165Vac
LPS	switches off at	Vac < 160Vac
Output voltage	Vdc Vdc	min = 11V max = 65V
Max. Temperature	ambient	up to 70°C

General composition

The R7633705 is the part number of the complete unit. This unit contains all necessary electronic circuits to work as an independent power supply unit for the Xenon lamp. This includes its own low voltage SMPS for the internal circuits. On exception: the built in microprocessor gets its supply via connector J619 from the external projector SMPS module.

It is composed of two boards:

R7632105 LPS-X Processor	**Functionality on board**
	• Power Factor Correction (PFC) • Primary circuits of the LPS • Feedback circuits • I²C Interface circuits. • µ-processor control of the PFC and LPS and its protections.

R7632113 LPS-X In/Out	**Functionality on board**
	• EMC filter with inrush limiter and bridge rectifier. • Internal Stand-By power supply • Secondary circuits of the LPS. • Lamp_voltage_sense. • Lamp_current_sense. • Boost voltage generator. • Fan Control

Visual indications LEDs

LAMP_ON (Green LED)	comes ON when the LPS provides power to the lamp.	
LVPS_OK (Yellow LED)	**On**	Mains volage above 85 Vac and internal low power supply is OK. The module is ready for lamp start up.
	Off	• Mains voltage not present or, • Fuse F100 in LPS module has blown up or, • internal low power supply is NOK
PFC_OK (Green LED)	is ON when the PFC is switches On and functions correctly.	
LPS_OK (Green LED)	is on when the LPS is switched On and functions correctly.	
ERROR (Red LED)	in case of an error detection, this LED comes On. Note: if the Red LED is ON, then the PFC nor the LPS can be started up.	

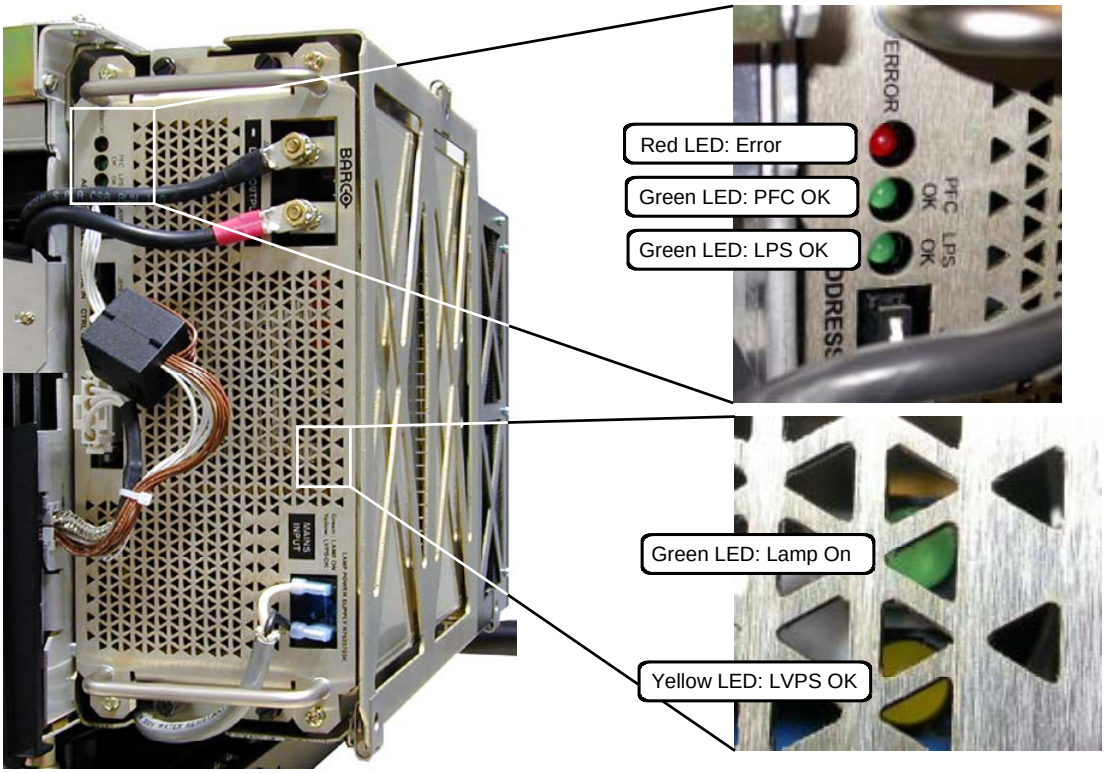


Image 15-4
View operation LEDs LPS

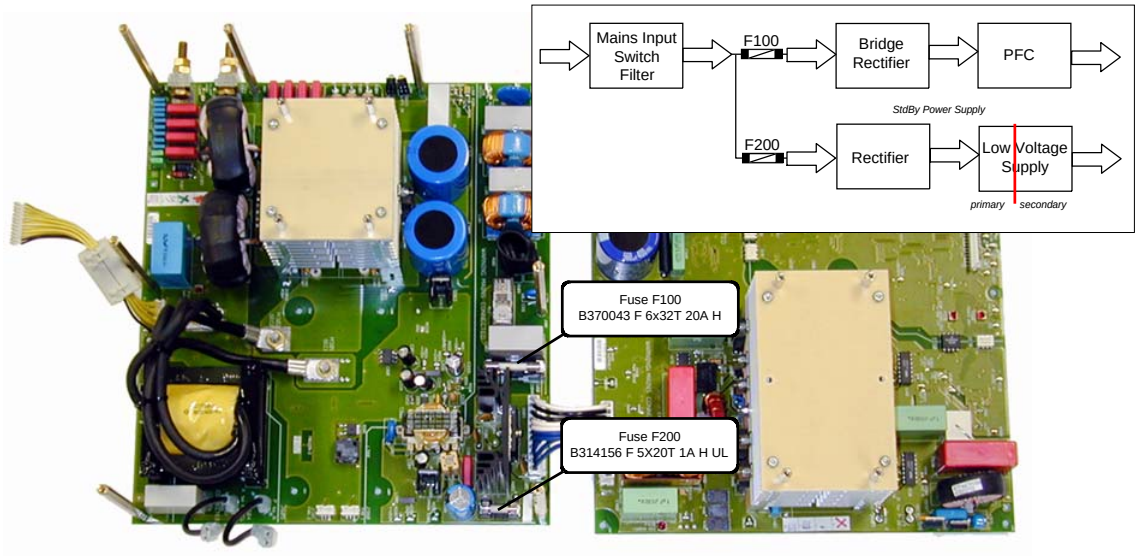


Image 15-5
Fuses on board

Connectors Primary side

J609	Through this connector the module is connected with the SMPS of the projector. The SMPS is supplied with the +380VM output of the PFC.	
	+380VM	In standby mode: Rectified mains volatge When PFC is active: +380V DC or +280V DC nominal
		The output is fused with F340 (1.25A) on the R7632103. The maximum power that can be taken from that line is 250W in standby and 450W in the operational mode.
	V-SIN	When the mains voltage disappears, this V_SIN also disappears but very quickly, in fact, much faster than any other supply line. The SMPS gets from this V_SIN a kind of warning that the mains supply is switched off and the processor on the SMPS can take all necessary measures to switch off the projector modules in the correct sequence. The DMD engine also requires a signal that informs the formatter board on the abrupt disappearance of the mains supply (short or relative short power supply interruptions).
J20/J21	MAINS _1/2	Mains_1 is the mains line input fused by a 20A (F100) located in the connector. Mains_2 is the return (Max. is 274V AC.).

Connectors Secondary side

J620	As this is a looped connector, this connector has the same pin layout as the CONTROL_IN connector (J619).	
	NOT_ERROR MAINS	This is an open collector output from the SMPS module. In the event of a fault condition detected on the projector SMPS, this line is dropped to a low level, hereby stopping the PFC and LPS.
J23	+LAMP_OUT	Positive output (95Vdc max) for the lamp.
J24	- LAMP_OUT	Negative output (return) for the lamp (approx. 0V)

15.3 Interconnection Diagrams

Mains (Power) Circuit

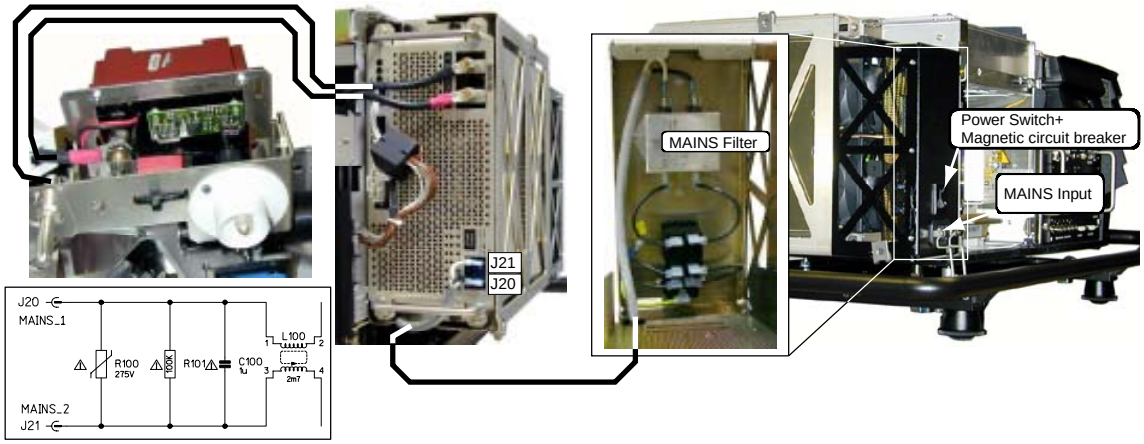


Image 15-6
Mains power circuit

Interconnection LPS & SMPS

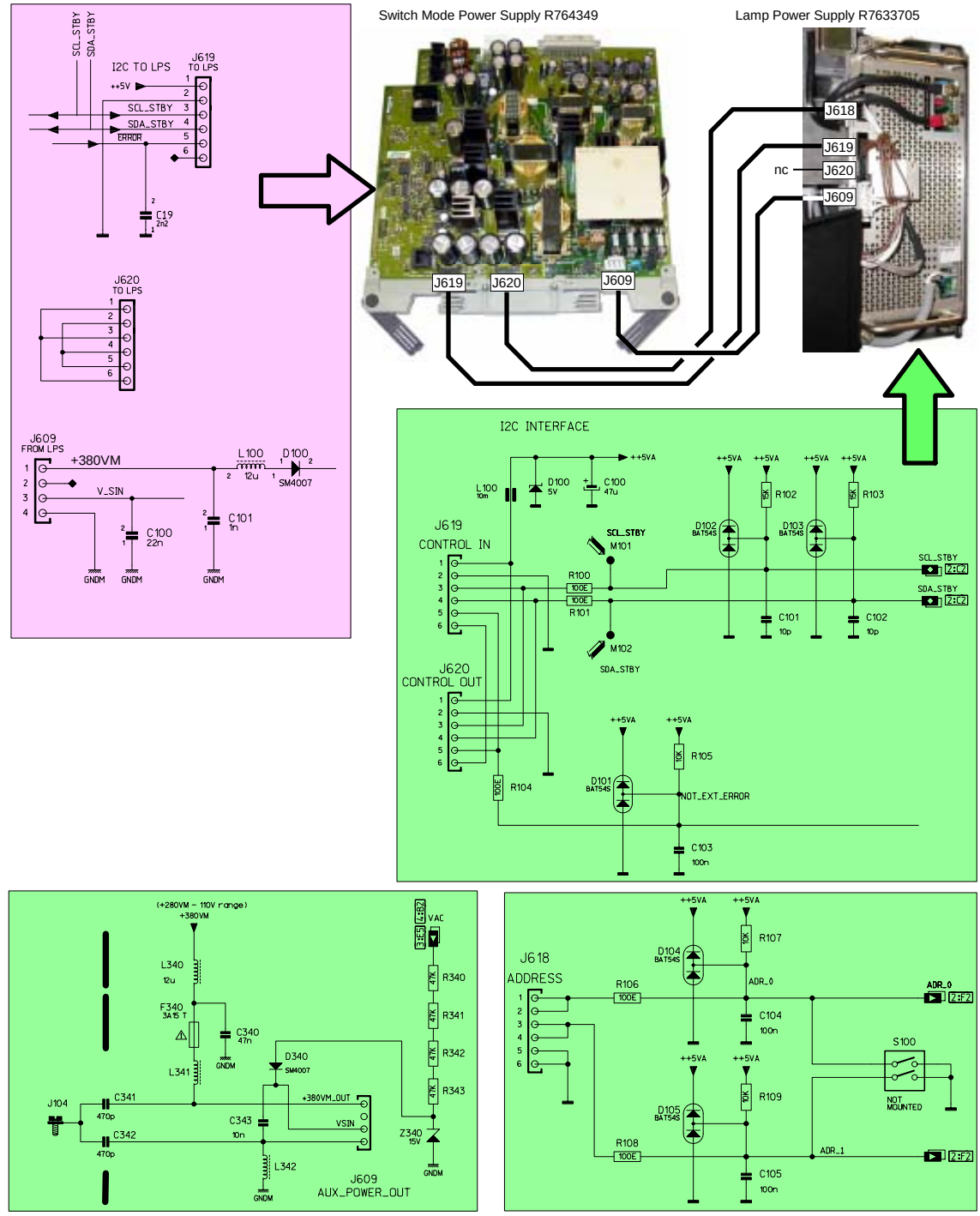


Image 15-7
Lamp Power Supply Control

Boards interconnection

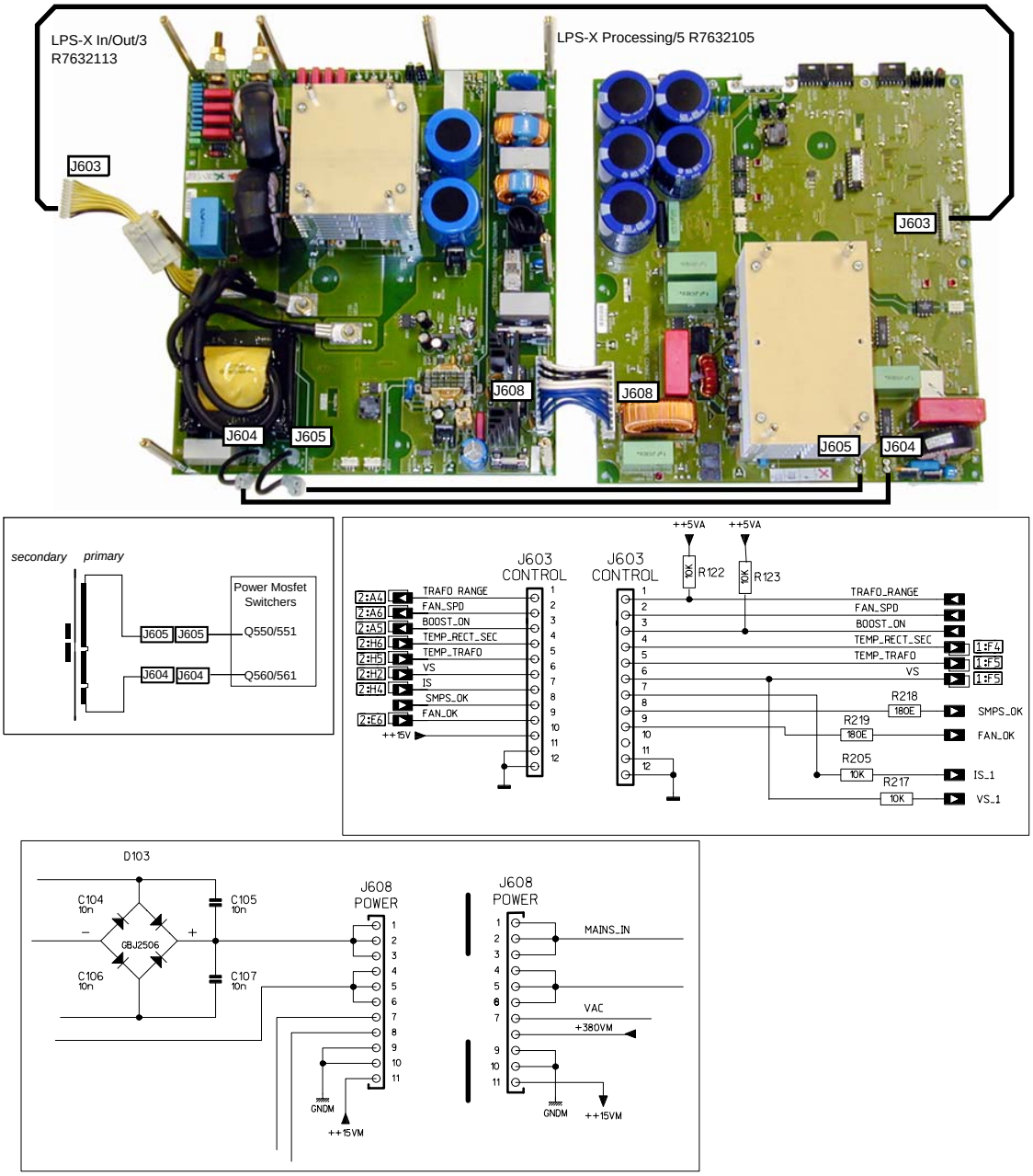
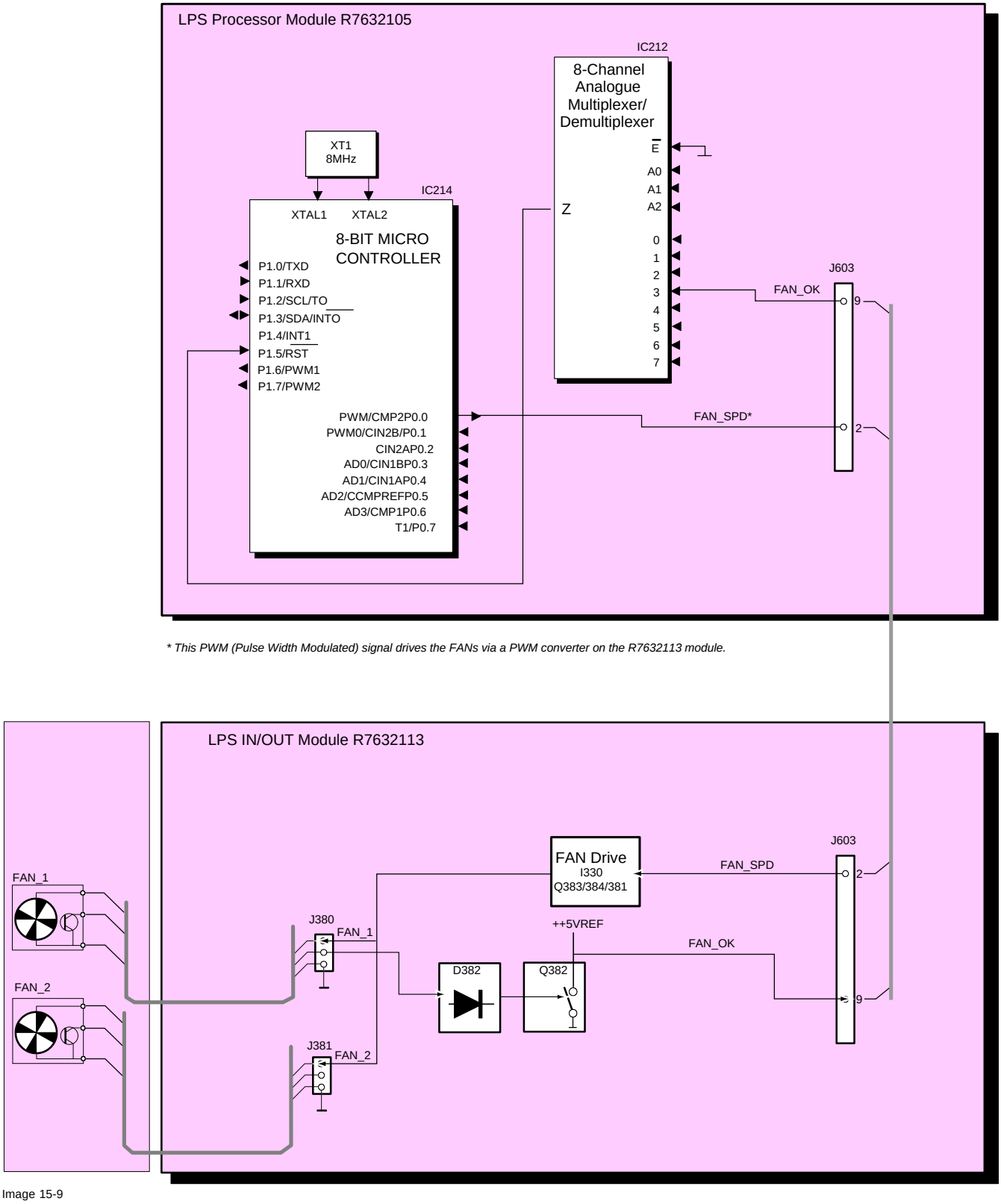


Image 15-8
Boards interconnection

15.4 Controls on Board

Lamp Power Supply FAN Control

Block diagram



** This PWM (Pulse Width Modulated) signal drives the FANs via a PWM converter on the R7632113 module.*

Image 15-9

FAN connection to Board

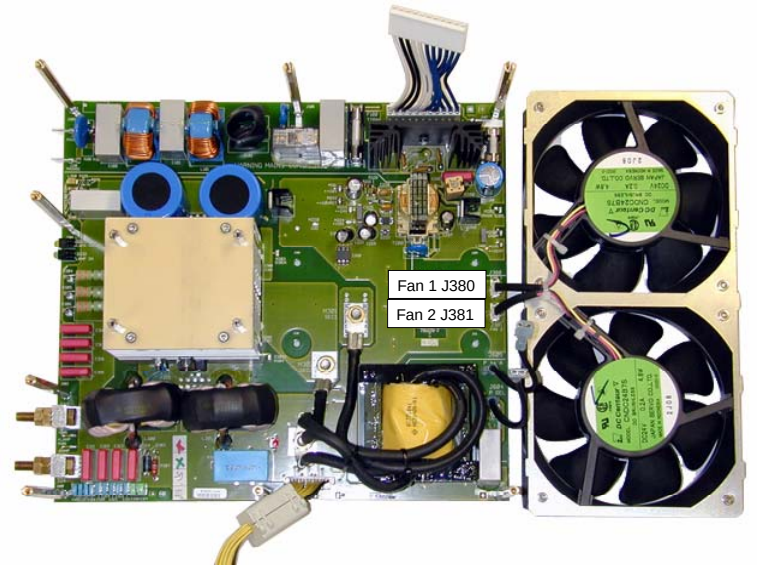


Image 15-10
FAN Connection to board

Temperature Sensing on Board

Block Diagram

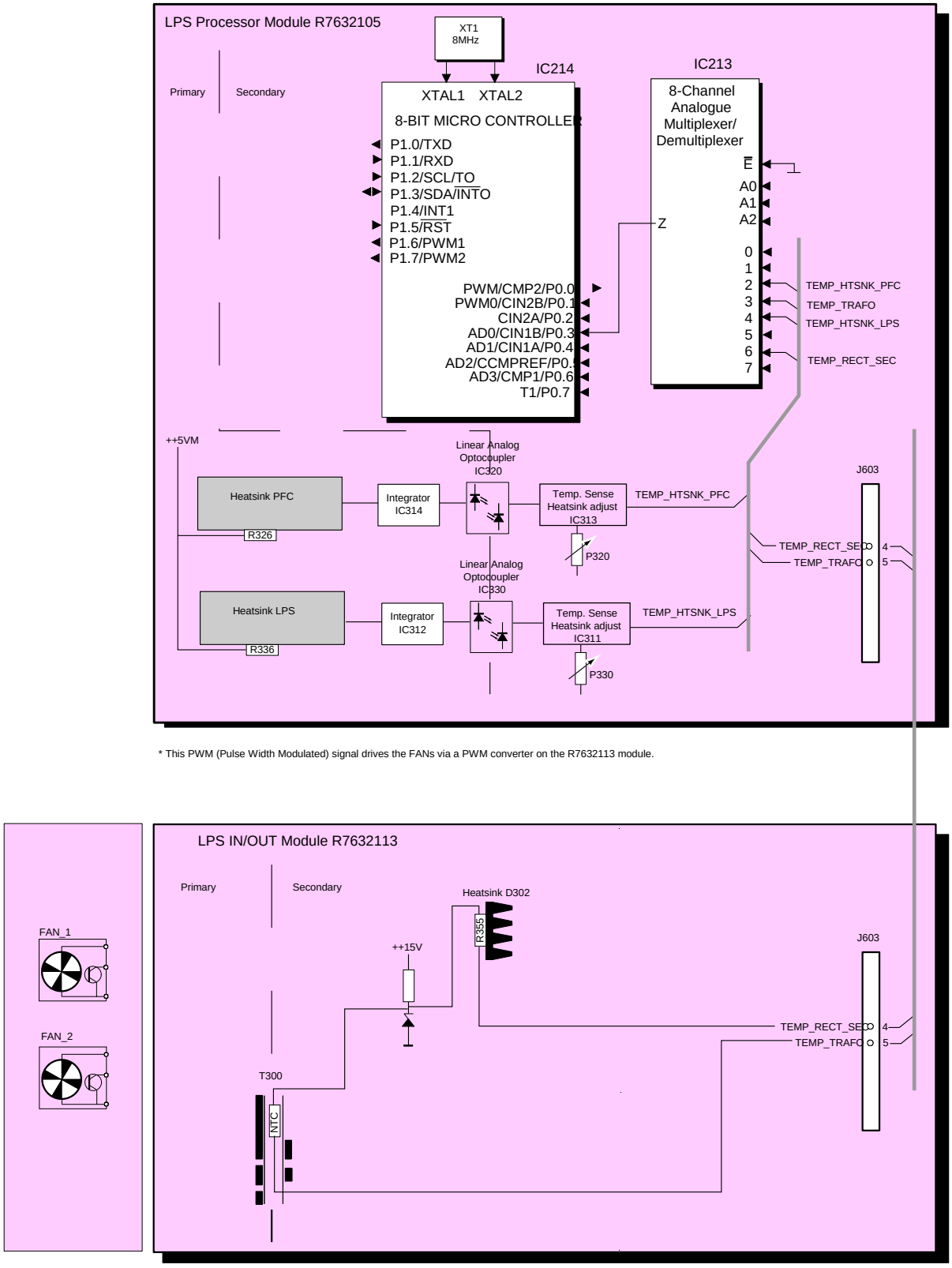


Image 15-11
Temperature Sensing on Board

Temperature Sensors location on board

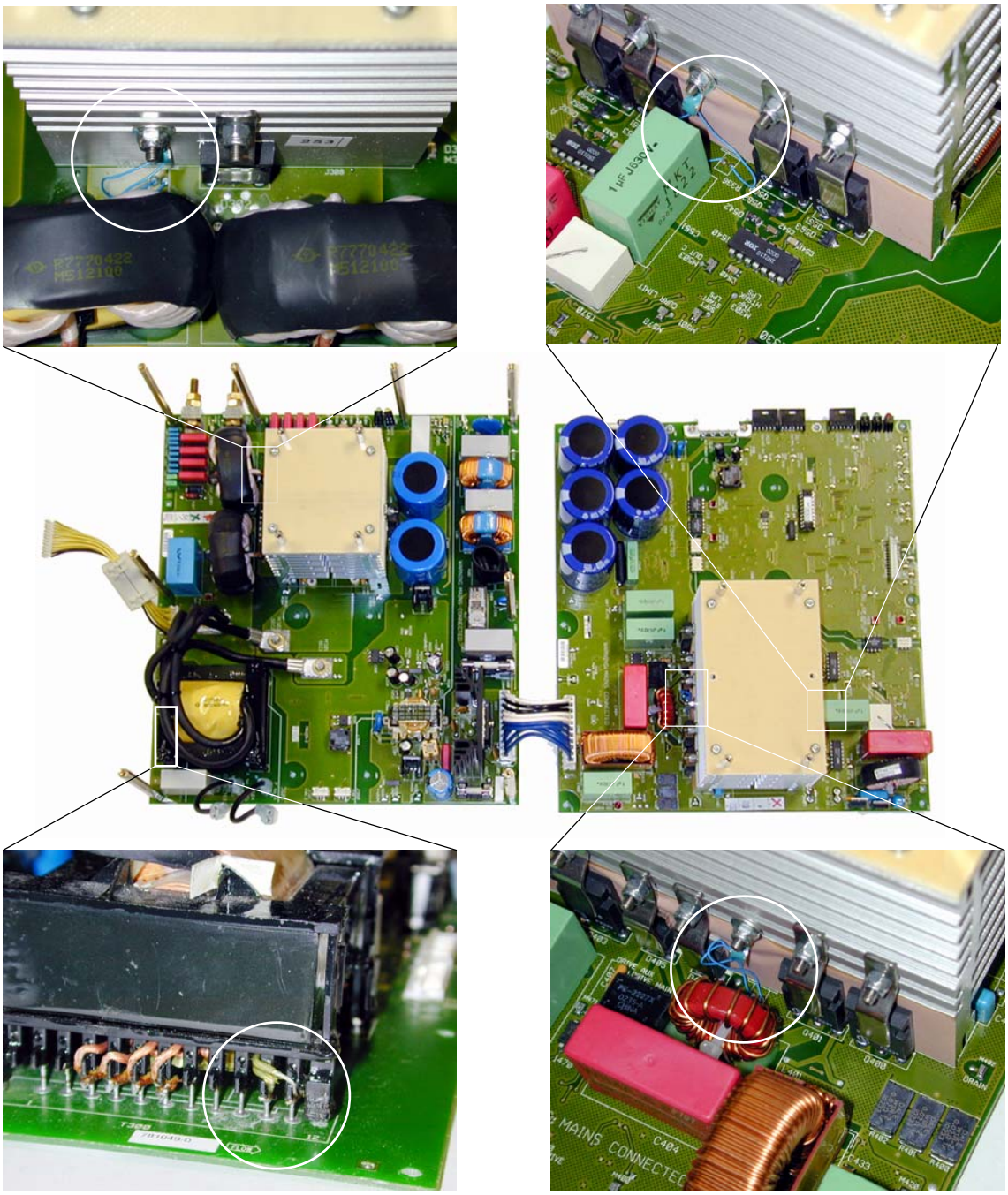


Image 15-12
Temperature Sensors location on board

15.5 Technical Description LPS-X In/Out R7632113

15.5.1 General

Preview

Module R7632113 is part of the complete lamp power supply . Together with the R7632105 (LPS-X PROCESSOR) it delivers the necessary power for the Xenon lamp.

15.5.2 Functions on the module:

Mains Input circuit: EMC filter with inrush current limiter and mains rectifier.

The output of this rectifier is connected to the other board R7632103 where we find the Power Factor Corrector circuit.

Low Voltage Power Supply.

This power supply (SMPS) generates the stand-by (remains active in the operational mode) voltages for the low power circuits on this module, the boost voltage circuits, and the fans.

Lamp Power Supply Secondary.

This board contains the transformer T300 of the HF DC/DC CONVERTER. This transforms the HF square wave input voltage (at 200kHz) to a lower value, at the secondary side, where D301 and D302 rectify the pulses to obtain the lamp voltage at the output.

Lamp_voltage_sense information.

The I330 sense the lamp voltage (signal VS is 0.1V for 1V on the lamp).

Lamp_current_sense information.

Isolating OPAMP and DC current to voltage converter of the lamp_current_sense information.

With these two information lines, the lamp voltage and current are measured and used by the controller IC to regulate the power of the lamp.

Boost voltage Generator.

The lamp needs an arcing or ignition voltage to start up. This is an AC voltage that can reach 40kV with a frequency of 3MHz.

The SPG (Start Pulse Generator) employs the lamp voltage as supply voltage (see SPG). This lamp voltage is boosted up during the start to 92V with a “boost circuit”.

From the moment the lamp is ignited, the boost circuit is switched off by the microprocessor.

Temperature Sensors

The temperature of the heatsinks of the secondary output diode (D302) is measured with an NTC resistor and the info is handled by the microprocessor on the R7632103.

Furthermore, a temperature sensor is incorporated in the T300 transformer as a protection element against overheating of the latter.

Led indications

The status of the smps is shown by the yellow LED (LVPS OK).

The status of the LPS is shown by the green LED (LAMP ON), This led is ON when the DC/DC converter delivers power to the lamp.

Important Note:

The secondary outputs are separated from the mains by base isolation. It is strongly forbidden to connect the device or a module to the mains without secure grounding.

15.5.3 EMC Filter - Rush-in Current Limit - Mains Rectifier.

Description

The mains input is connected via the connectors J20 and J21.

Fuse F100 is designed to blow as a result of over current brought about by a possible defect in the module. Thereby the projector can also operate on a lower power with other lamp supply modules (redundancy).

The mains voltage passes first a double EMC filter C100/L100 and C101/L101. Resistors R102 to R104 limit the inrush current loading the big smoothening capacitors on the other board.

To avoid unnecessary heating, these resistors are shorted with RL1 which is supplied from the ++15VM generated by the standby SMPS on this board. The diode bridge D103 rectifies the AC voltage.

A relative small smoothening capacitor of 1µF (on the other board) is sufficient at this stage, because a PFC circuit follows.

By means of two diodes D101 and D102, the shape of the AC waveform is checked and used by the PFC controller IC on the other board R7632105 to modulate the current.

15.5.4 On-board SMPS.

Description

This “flyback SMPS” is built around I200, TOP223Y, performing all necessary functions for driving the primary of the transformer T200 and the stabilization of the output voltages.

The input voltage is the +380VM via the connector J608, pin 8, from the other PFC board R7632105. The fuse F200 interrupts this connection in case of a fault (short) in the SMPS.

The transformer delivers one primary and three secondary voltages :

Primary Voltages	++15VM	• used as feedback information for stabilization of all output voltages. • used in circuits with "hot ground" on this board and via connector J603 on the other board R7632103.
Secondary voltages	++24V	mainly used for supplying the two fans.
	++15V	used on sheet 2/2 for several circuits, and also stabilized down to a stable ++5Vref.
	++110V	a floating voltage used to charge up the boostup capacitors (for the start up of the lamp)

The SMPS starts up from 80Vac onwards. When the SMPS is in operation, the +380VM must drop first to 50V before the SMPS is switched off. This accelerates the discharge of the electrolytic capacitors at the PFC output on the module R7632105.

15.5.5 Secondary circuit of the LPS.

Description

The separation / isolation between primary and secondary is realized with transformer T300. The relay RL2 , supplied from the line TRAFO_RANGE, can change the ratio Nprim / Nsec from LOW to HIGH. The ratio changes from 22/3 to 17/3.

Inside the transformer, a temperature sensing NTC resistor T300 provides an increasing voltage with temperature at the TEMP_TRAFO line.

This information is handled by the microprocessor and the projector is shut down when the transformer reaches a predefined over-temperature value, a value stored in eeprom on the R7632105.

The reverse voltage across the rectifier diodes may be maximum 300V. The most critical is the switching off time of the diodes. Heavy ringing at turning off the diodes should be avoided.

A snubber 100E/1nF clamps too high ringing voltages.

The 100A coils L300 and L301 filter the HF components of the rectified current.

The capacitors C308 in parallel with a capacitor of 3000µF (C309+C310) (when the relay contacts are closed) filter the DC lamp voltage.

At starting up, the lamp voltage is boosted up by the boost circuit around Q363 up to 105V and this high lamp voltage switches on Q364. The relay RL3 opens its contacts and puts hereby a 1 Ohm in series with the electrolytic capacitors. From the moment the lamp starts, the capacitors discharge through this 1 Ohm. The lamp voltage drops and the relay goes in rest position, shortening the resistors. The electrolytic capacitors are now in parallel on the lamp electrodes.

15.5.6 Measurement of the lamp voltage.

Description

The lamp voltage at the secondary side must be measured and sent to the controller IC on the module R7632103.

The I330 buffers the voltage from the divider R334, R335.

The output VS (Voltage Sense) is led out to the other board via pin 6 of the CONTROL connector J603.

The voltage division is such that we obtain a ratio of 10 or, VS = 0.1V for 1V on the lamp.

Because the controller module on the R7632103 only can handle voltages up to 5V, **the maximum lamp voltage that can be measured is 50V**.

15.5.7 Lamp Current Measurement.

Description

The lamp current is relatively high and is a DC current.

A trace on the pcb (printed circuit board) board serves as current sense resistor (R340). The sensed voltage is amplified with I340 and I341, and the output voltage IS is adjusted with P340 to be equal at 0.04V for 1A in the output.

The NTC R346 compensates resistance variations in the pcb trace when the temperature varies.

The **maximum lamp current that can be measured is 125A.**

15.5.8 Boost up circuit.

Description

The ++110V , ++110RET voltage is a floating supply delivered by the on-board SMPS. When the opto-coupler is switched ON by the processor (BOOST_ON) The ++110V voltage charges up the capacitors C309 /C310 via the current source Q363. This current is determined by the zener voltage of Z360, the threshold of Q363 and the source resistors R373+R374.

As soon the zeners Z361 to Z363 start conducting, the transistor Q361 which drives Q362 reduces the current of the current source. A stable situation is reached until the processor turns off the opto-coupler and consequently also the MOSFET.

During that stable situation, the voltage across the lamp is roughly the sum of the three zeners Z361+Z362+Z363, this is **93V**.

15.5.9 Fan drive

Description

Because the fans only can start when the boost circuit is switched off and have to continue cooling after the LPS is turned off, the drive is done by the processor with the FAN_SPD line.

The two fans are connected in parallel and pulse width modulated with Q381. Because the SMPS cannot supply the fans and the boost circuit simultaneously (this would require too much power from it), the fans only are started when the boost circuit is turned off.

The time the fans keep blowing after switching off, is programmable.

The signal FAN_OK goes low when either of the fans does not rotate.

15.5.10 LAMP_ON green LED indication.

Description

The secondary transformer outputs SEC1 and SEC2 of T300 are rectified with D330 and D331, and applied to the base of Q330.

The LED turns on from a lamp voltage of 12V onwards.

15.6 Technical Description LPS-X Processing R7632105

15.6.1 General

Preview

This module is part of the complete LPS and performs following functions :

- A microcontroller with I2C interface an peripheral circuits for controlling and monitoring the LPS module
- PFC Power factor Corrector.
- Primary of the LPS and a part of the feedback circuits.

15.6.2 Controller circuits and controller interface circuits:

On sheet 1/5

The connector J619 (CONTROL IN) realizes the connection with the SMPS and carries the I²C bus lines SDA and SCL.

J620 is the CONTROL OUT connector (in parallel or 'looped through') to the second or third LPS unit, if present.

The ++5V supply voltage for the secondary circuits (with cold chassis ground) comes from the SMPS via J619.

A local ++15V and -13V are generated with the circuit around I150.

The SCL and SDA lines, and the two address lines from J619 are directly connected to the controller I214 on sheet 2/5.3

On sheet 2/5 and sheet 3/5

The controller I214 has following inputs & outputs:

8 Digital Inputs	
NOT_EXT_ERROR	This is an input from the SMPS module in the projector; a low level indicates an error, and shuts down LPS and PFC.
ADR_0	First address line from J619/J620.
ADR_1	Second address line from J619/J620.

8 Digital Inputs	
FAN_OK	From the fan drivers on the R7632113 module. Is high when the fans are switched on and will become low when either of the internal fans fails.
MAINS_HIGH	Is high when the mains input is in the 230V range.
PFC_OK	Is high when the PFC is switched on and shows no malfunction.
LPS_OK	Is high when the LPS is switched on and shows no malfunction.
SMPS_OK	Is high when the internal LV SMPS on the R7632113 shows no malfunction.

8 Digital Outputs	
ERROR_OUT	Drives the red LED D121 (ERROR) via Q122 (on sheet 1/5).
LPS_ON	A high level switches on the LPS via optocoupler I300 on sheet 3/5.
PFC_ON	A high level switches on the PFC via optocoupler I300 on sheet 3/5.
TRAFO_RANGE	A high level modifies the step down ratio of the LPS trafo on the R7632113 for the high lamp voltage range.
MAINS_RANGE	A high level switches the module to the 220V-only 3kW range a low level switches the module to the 110/220V 1.5kW range.
PFC_LED	Drives the green LED D231 (PFC_OK).
LPS_LED	Drives the green LED D230 (LPS_OK).
BOOST_ON	A high level switches the boost voltage generator on the R7632113 module on.

8 Analog Inputs	
IS	Sense signal from the R7632113 module, sensitivity: 0.04V for 1A lamp current.
VS	Sense signal from the R7632113 module, sensitivity: 0.1V for 1V lamp voltage.
TEMP_HTSNK_PFC	Analog voltage that represents the temperature on the PFC heatsink. Analog optocoupler I320 on sheet 3/5 couples this analog voltage from the primary to the secondary.
TEMP_TRAFO	Analog voltage that represents the temperature on the LPS trafo on the R7632113 module.
TEMP_HTSNK_LPS	Analog voltage that represents the temperature on the LPS heatsink. Analog optocoupler I330 on sheet 3/5 couples this analog voltage from the primary to the secondary.
PFC_OUT_S	Sense signal from the PFC output, sensitivity 0.01V/V. Analog optocoupler I310 on sheet 3/5 couples this analog voltage from the primary to the secondary.
TEMP_RECT_SEC	Analog voltage that represents the temperature on the sec rectifier heatsink on the R7632113 module.
BOOST_OUT_S	Sense signal from the R7632113 module, sensitivity: 0.025V for 1V lamp voltage (see voltage divider on sheet 1/5).

3 PWM (pulse width modulated) outputs	
DIM	the PWM signal is integrated with R257 and C253 to an analog signal (1 to 5V). This voltage controls linearly the dimming of the LPS output. With DIM = 0V the output power is at maximum (1.5kW or 3kW, depending on the level of Mains_Range. With DIM = 5V the output power is reduced to zero.

3 PWM (pulse width modulated) outputs	
VL_MIN	The PWM signal is integrated with R253 and C251 to an analog signal (1 to 5V). This voltage controls the maximum output current of the LPS. With VL_MIN = at low values (depending on the adjusted power) the maximum output current is kept below 110A (hardware current limit in the LPS). With VL_MIN = 2V the maximum output current is kept below the value <adjusted power level in Watts> divided by 20V. With VL_MIN = 5V the maximum output current is kept below the value <adjusted power level in Watts> divided by 50V.
FAN_SPD	This PWM signal drives the fans via a PWM converter on the R7632113 module.

EEPROM I210

This EEPROM contains values that control protection levels (temperature and voltage levels), lamp voltage ranges, look up tables for temperature measurements conversion, and module serial number).

AMBIENT TEMP SENSOR I215

This I2C controlled circuit measures the module internal ambient temperature.

FEEDBACK CIRCUITS ON SHEET 2/5

The signals VS and IS coming from module R7632113 via connector J603 are representative of the module output levels:

- VS is a measure of the module output voltage, sensitivity: 0.1V for 1V at the output.
- IS is a measure of the module output current, sensitivity: 0.04V for 1A at the output.

Both are multiplied in the analog multiplier I251, where also an offset voltage equal to the signal DIM is added.

The resultant output voltage POUT_S is via an analog optocoupler I270 coupled to the primary LPS controller (on sheet 5/5).

The LPS controller regulates the LPS output such that POUT_S is kep constant.

As a result the product VS x IS is also constant, so the module is keeping its output power level at a constant level, depending on the value of the signal DIM.

(The clamp circuit in I250, output pin 8 is not used, as diode D251 is not mounted).

SIGNAL VIN_RMS on sheet 3/5

This analog voltage is a measure of the ac input mains voltage, sensitivity 0.02Vdc for 1Vrms at the input. Its level controls:

- the output voltage of the PFC: 380Vdc for mains voltages above 180Vrms, 280Vdc for mains voltages below 175Vrms (circuit around I370 and Q370, and signal PFC_OUT_LEVEL that modifies the feedback in the PFC controller on sheet 4/5).
- the undervoltage protection that prevents the PFC startup for too low mains voltages. See next paragraph.

MAINS_RANGE SELECT on sheet 3/5

With the signal MAINS_RANGE SELECT, several circuits are adjusted to different values depending on the input mains range. The module has two ranges, depending on the level of MAINS_RANGE SELECT.

230Vac only range	Signal MAINS_RANGE SELECT is low, and Q360/361 are conducting:
• The level at pin 7 of I370 is increased and prevents startup of the PFC for input voltages below 190Vac. • The 5V level on POWER_LIMIT_RANGE programs the PFC controller I420 on sheet 4/5 for 3kW max.	

120/230Vac universal range	Signal MAINS_RANGE SELECT is high, and Q360/361 are blocked
• The lower level at pin 7 of I370 prevents startup of the PFC for input voltages below 85Vac. • The low level on POWER_LIMIT_RANGE programs the PFC controller I420 on sheet 4/5 for 1.5kW max.	

15.6.3 Power Factor Corrector (sheet 4/5)

Introduction

The PFC must take current from the mains line in phase with the voltage which is understood to have a sinus shape. This function can be combined with a stabilization of the output by adjusting the amplitude of the current using a boost converter circuit. All this is controlled by the L4981A (I420).

The rectifier bloc on the other board R7632113 is terminated with a small capacitor C400/C401 just to remove the HF components (130khz) generated by the DC / DC converter.

The 50 or 60Hz of the mains voltage is not removed by these capacitors and the rectified sinus waveform is presented to the input of the DC/DC converter. The amplitude is the peak value of the sinus (eg. +325V for a 230Vrms).

This input voltage is boosted up by the DC/DC converter to +380V independent of the mains input voltage.

The boost converter power stage

This power stage consists of

- switcher Q400-Q401
- Coil L400
- rectifying diode D404
- smoothening capacitors C410-C414.

The switching frequency is approximately 130kHz and the duty cycle is regulated by the controller I420.

Controller I420

I420 (L4981A) is an average current mode controller designed for power factor correction. The oscillator is tuned at 130kHz (R432 / C429).

The power supply voltage is ++15VM to pin 19. This supply voltage is monitored with the P-UVLO input pin 15. When this pin is below 13.5V the drive to the Mosfets is stopped. If the PFC does not work, the LPS cannot work neither. Thus, this is a protection for a too low 15V on the LPS circuit as well.

In standby position the pin is low via D421, because the PFC_ON_M line is at a low level.

The capacitor C433 is the soft start capacitor. The voltage across this capacitor determines the status of the controller.

If too low, the drive is interrupted. This will happen when the mains voltage drops below 160V.

The VAC is applied on pin 6 of the comparator I370 with the divider R350/R351/R352/R354/R353. Pin 7 of I370 can discharge C433 as soon the mains voltage drops below 160V. From 170V onwards the controller starts up again, with a soft start, by charging up C433.

The current in the switcher Q400-Q401 is measured with the sense resistors R400/R401/R402. When a maximum is got, the mosfets are turned off. This maximum amplitude changes in step with the measured voltage. The controller knows the mains voltage via the IAC pin 4 through R424/R425/R426. Hereby is guaranteed that we have a sinus shaped current in phase with the sinus voltage.

Besides correction of the power factor, we need to make sure that this maximum current is sufficient to feed the output load. A voltage feedback loop R7447/R448/R449/R450/R451P420/R452 supplies the VFEED pin 14 with this information.

C432/R438 is a compensation for possible oscillations in this feedback circuit.

The voltage divider R442 - R446 feeds the overvoltage pin (OVP, pin 3). The threshold is hereby set at 420V maximum.

The controller starts up again without a soft start from the moment the voltage drops below 420V.

The filter R420/R421/C420/C421/R422/R423/C422/C423 feeds an RMS (Root Mean Square) information to the VRMS pin 7. With this information, the PFC circuit will show a saturation or limitation of the delivered power independent of the RMS value.

Auxiliary circuit for zero loss (zero volt) switching

This auxiliary circuit eliminates the switching losses of Q400-Q401 during switching on and switching off. The same circuit equally minimizes the switching power in the diodes and the auxiliary switcher itself Q403.

Hereafter we"ll discuss in detail the switching on and off phenomenons.

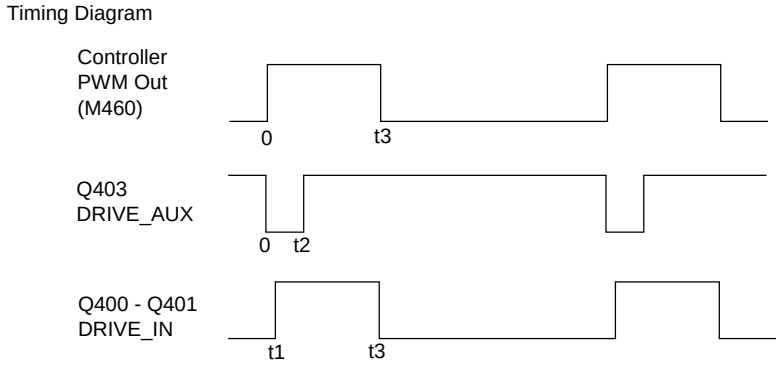


Image 15-13
Timing diagram

Switching on of Q400-Q401.	
	A short while before Q400-Q401 are driven into conduction, Q403 stops conducting (see timing diagram). Just before Q403 stops conduction, there flows a current in L401/Q403/C404. This current is modulated on the input current flowing through L400/L401/D404 towards the output. The above current charges up the D-S capacitor of the MOSFETS and this means that Q403 can switch off with a minimum of losses. Even when the mosfet Q403 fully stops conducting the coil L401 tries to maintain the current . This current now flows in the following circuit : D404/C408,C409/GNDM /D-S cap. of MOSFETS and the parallel capacitors C402, C403. The above current discharges C402/C403 from 380V to 0V. As soon these capacitors are discharged the inverse diodes in the Mosfets Q401/Q402 start conducting and this is the moment to drive the mosfets in conduction (see timing diagram t1). The input current, flowing in L400 via D404 to the output, gradually is taken over by the drain current of Q401-Q402. The di/dt decrease of the diode current is slow due to the L401, hence its dissipation is low. There flows however an inverse recovery diode in D404. This current finds its way through C404 D-S cap. of Q403. The drain-source capacity is discharged from 380V to 0V and the inverse diode of Q403 starts conduction. This is the moment to drive the mosfet on (t2). When Q403 is conducting, the current in L401/C404/Q403 reverses and becomes a forward current in Q403 (from drain to source). This is the current mentioned in the start....

Switching on of Q400-Q401.	
	The switching off time of the main switchers happens when the PWM output of the controllers goes low. Q403 remains in conduction to maintain the current in the mentioned circuit (see “switching on”). Elimination of the switching losses happens by adding the capacitors C402/C403 in parallel with the drains of the mosfets. At switching off, the drain current must now charge up first these capacitors. The drain voltage increases slowly and, hence, the drain current decreases equally slowly. Above only is possible on condition these capacitors are discharged by the above-mentioned diode reverse recovery current (see switching on). Short voltage peaks are removed by D403/C405. The physical position of these components is such that they are very close to the drains in order to limit the peaks to 500V. R413 provides a discharge path for the capacitor to the output.

Drive of the power Mosfets

The timing diagram of the drive of the main switchers Q400-Q401 and the auxiliary switcher Q403 can be as seen (see timing diagram).

- Floating drive Q403 (OUT A of I470).
  The off time of Q403 must be constant and start coincident with the rising edge of the PWM output. This time (0-t2) is programmed with monostable I460 to input A of driver I470.
  Since we require a floating drive between -30V and +380V, a pulse transformer is used.
- Drive of the main switchers.
  The delay between the rising edge of the PWM output and the switching on time of the main Mosfets is programmed with the monostable I460 to input B of driver I470.

I470 is a non-inverting mosfet power driver generating drive pulses having 15V amplitude.

For the main (powerful) switchers a buffer is necessary to drive power FETs with a high input capacitance at a high frequency.

Temperature protection

An NTC resistor, mounted on the heatsink of the converter, is part of a resistive divider (R326 TEMP_HTSNK_PFC and R336 TEMP_HTSNK_LPS). The output of this divider is checked by the microprocessor which calculates the heatsink temperature from the non-linear input (NTC is a non-linear device).

As soon a programmable threshold is reached , both, the PFC and the LPS are switched inactive.

15.6.4 Primary LPS

Feedback (see sheet 2/5).

The feedback informations IS and VS enter via J603 from module R7632113 and need to be multiplied in the analog multiplier I231 (74HC4051) on sheet 2/5.

IS is proportional with the lamp current and related as 0.04V / $A_{lamp.}$

VS is proportional with the lamp voltage and relates as 0.1V / $V_{lamp.}$

The output voltage W (PS) (pin 5) is function of the feedback voltage returned to Z or pin 4 of I251.

Since X2 = Y2 = 0 the output voltage is:

$$PS= \frac{VS + IS}{10} \times \frac{(R261+R262+R260}{(R261+R262)} +DIM$$

$$PS= \frac{VS \times IS}{2.4} +DIM$$

The feedback circuit starts regulating from 2.5V onwards (internal reference level of the controller I500). The PS output pin 5 of the analog multiplier must therefore reach 4V (taken into account the divider R263 / P260 / R264).

Dimming

- DIM = 0 V (max. power)
  If DIM=0V and the PS output should be 5V, then VS x IS = 10V
  Taken into account the ratio's between Vlamp / VS and Ilamp / IS we can calculate that: $V_{lamp} \times I_{lamp} = \frac{8}{0.1 \times 0.04} = 200W$
- DIM = 2
  If we apply the above formula, we see that VS x IS should be 8V now. The output power for the lamp will consequently be reduced to 1000W .
  The DIM voltage is generated by the microprocessor I214 and added to the offset of the analog multiplier.

Current limiting

When the regulating circuit stabilises the lamp power, the current will increase heavily when the lamp voltage drops. However, there are limits for the circuit and for the lamp itself. This limitation is realised with the voltage clamper built around I250. Let us illustrate this with an example.

Assume we like to limit at 80A. This corresponds with a lamp voltage of 25V when the power is stabilised at 2000W.

In this case the controller will install a VL_MIN = 0.1 x min. voltage, or, 2.5V.

D250 remains reverse biased as long the VL_MIN voltage is higher than this limit. But, when VS would like to drop below the pin 5 level, the diode is forward biased and clamps pin 1 of the analog multiplier at 2.5V.

This means that the output current, irrelevant the lamp voltage being lower than 25V , will be limited at 2000W/25V = 80A.

In general, the VL_MIN is calculated by the processor in function of the lamp power as follows: $VL\_MIN = \frac{P_{lamp}}{10 \times I_{max}(\text{in A})}$

A second clamper implements a 2V at the comparator input pin 5. This is a second protection of the maximum current on a higher level.

In the unlikely event that the microprocessor would fail to generate the VL_MIN voltage.

At a 2000W installed power, the 2V level means a current limitation at 100A.

Controller I500

I500 is a controller IC from Unitrode generating the four drive outputs for a phase shift modulated full bridge (4 power Mosfet switchers).

The oscillator frequency is tuned at 200 kHz (C800-C809), the transformer works at 100kHz and thus the converter again at 200kHz (full phase rectifier).

The controller can be stopped and turned on via the Soft Start (SS) pin 19. The dead time between the A/B and the C/D outputs is installed with the resistors R508 and R509 and the voltage at pin 11 (ADS) .

With an increase of the primary current, the dead time is shortened since the output capacitance of the FETs are much faster charged up and discharged when the current goes up.

The analog multiplier output is adjusted with P260. The adjusted voltage on P260 is sensed by the isolation amplifier I270. A differential output volatge is created on the other side of the I270 optical isolation barier. This differential voltage is converted to a single-ended signal PENSE_M by I312 and feeds pin 1 inpuT of the controller I500.

The internal reference in the controller IC is 2.5V. This means that the feedback circuit will adjust the power until the voltage at pin 1 is 2.5V. To reach this 2.5V, the lamp voltage and lamp current are constantly adapted. By adding an offset to the Z-input of the multiplier we can "mislead" the controller and this is used for dimming purposes.

This regulation circuit is relatively slow, a fast (dynamic) current limitation is necessary. A current transformer 1 : 100 feeds a current proportional voltage to pin 12 at low impedance. This pin has a two-level detector.

From the 2V level onwards, the drive of the FETs is momentarily stopped. If however a 2.5V is applied, the controller completely stops and re-starts with a soft start.

Drive of the full bridge mosfets

The respective outputs are directly supplying, via a 10 Ohm, the High (HIN) and Low (LIN) inputs of the FET drivers IR2110.

To speed up the discharge of the gate-source capacitors a discharge-transistor (Q552, Q553, Q562, Q563) is added in the gate drive.

The four FETs form a full bridge. The primary of the transformer (on the other board) is connected at the J605/J604 in series with the blocking capacitors C570, a primary coil L570 and the current transformer.

Ringing is limited with the clamper D570/D571.

15.7 Pin Assignment Connectors on Board

Overview connectors on Board

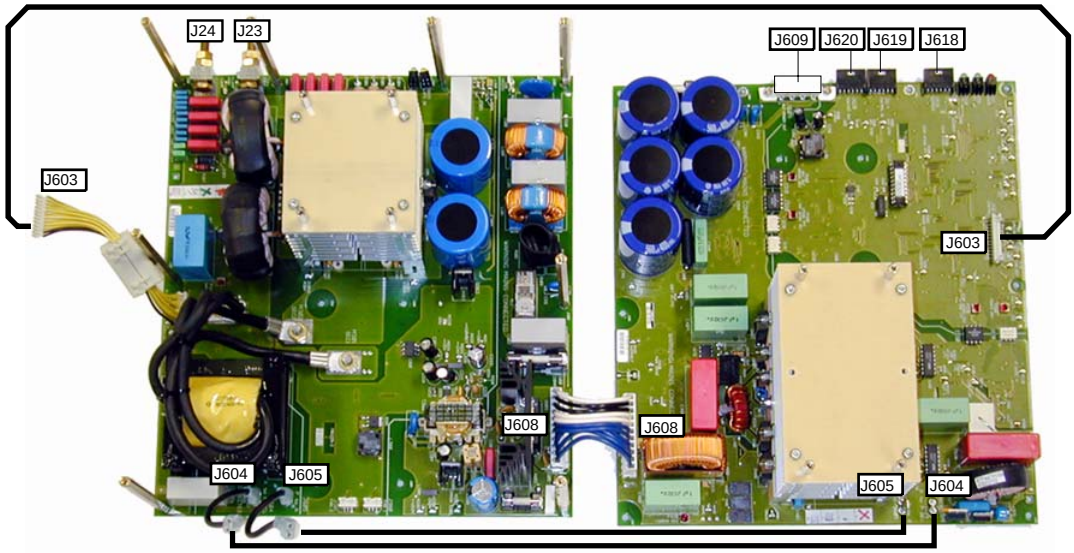


Image 15-14
Overview connectors on Board

Connectors on LPS Processor Board R7632105

Connector: J609 AUX POWER OUT (!! Mains Connected !!)				
Pin Name	**Pin No**	**In/Out**	**Description**	**Signal**
+380VM	1	O	380 V Output to SMPS	380V dc
	2			
V_SIN	3	O	Full wave rectified mains supply, limited on 15V by a zener (Mains voltage monitoring)	0-15V max
GND	4	O	Primary ground	

Connector: J604 LPS Primary OUT1 to R7632113 (!! Mains Connected !!)				
Pin Name	**Pin No**	**In/Out**	**Description**	**Signal**
P_t_A Pulses	1	I	Passive to Active LPS Output	380V

Connector: J605 LPS Primary OUT2 to R7632113 (!! Mains Connected !!)				
Pin Name	**Pin No**	**In/Out**	**Description**	**Signal**
PRIM_2 Pulses	1	I	Lamp Supply Primary Output 2	380V

Connector: J603 Controls				
Pin Name	**Pin No**	**In/Out**	**Description**	**Signal**
TRAFO_RANGE	1	I	Lamp Voltage Range Select	0-5V
FAN_SPD	2	I	Fan Speed control	0-5V
BOOST_ON	3	I	Boost Enable Voltage	0-5V
TEMP_RECT_SEC	4	O	Temp Sense Heatsink Sec Rectifier	0-5V
TEMP_TRAFO	5	O	Temp Sense LPS Trafo	0-5V
VS	6	O	Lamp- Voltage Sense Voltage	0-5V
IS	7	O	Lamp-Current Sense Voltage	0-5V
SMPS_OK	8	O	HIGH IF LV SMPS IS OK	0-5V
FAN_OK	9	O	HIGH IF FANS OK	0-5V
++15V	10	O	Rectified Voltage	0-5V
GND	11	-	Secondary Ground	
GND	12	-	Secondary Ground	

Connector: J618 Address Select				
Pin Name	**Pin No**	**In/Out**	**Description**	**Signal**
ADR 0	1	I	Adres select bit nr 0	5V dc
ADR 0	2	I	Adres select bit nr 0	5V dc
ADR 1	3	I	Adres select bit nr 0	5V dc
ADR 1	4	I	Adres select bit nr 0	5V dc
GND	5	O	Secondary ground	0
GND	6	O	Secondary ground	0

Connector: J619 Control In				
Pin Name	**Pin No**	**In/Out**	**Description**	**Signal**
++5V	1	I	++5V secondary supply voltage	5V dc
GND	2	I	Secondary ground	0V
SCL_STANDBY	3	I/O	I^2C CLOCK SIGNAL	5V PULSES
SDA_STANDBY	4	I/O	I^2C DATA SIGNAL	5V PULSES
NOT_ERROR_M	5	I	Error signal from SMPS	0 or 5V
	6			

Connector: J620 Control Out				
Pin Name	**Pin No**	**In/Out**	**Description**	**Signal**
++5V	1	I	++5V secondary supply voltage	5V dc
GND	2	I	Secondary ground	0V
SCL_STANDBY	3	I/O	I^2C CLOCK SIGNAL	5V PULSES
SDA_STANDBY	4	I/O	I^2C DATA SIGNAL	5V PULSES

Connector: J620 Control Out				
Pin Name	**Pin No**	**In/Out**	**Description**	**Signal**
NOT_ERROR_M	5	I	Error signal from SMPS	0 or 5V
	6			

Connectors on LPS In/Out Board R76321113

Connector: J20 Mains 1 (!! Mains Connected !!)				
Pin Name	**Pin No**	**In/Out**	**Description**	**Signal**
MAINS_1	1	I	Mains Line Input	Max 264Vac

Connector: J21 Mains 2 (!! Mains Connected !!)				
Pin Name	**Pin No**	**In/Out**	**Description**	**Signal**
MAINS_2	1	I	Mains Return	Max 264Vac

Connector: J608 Rectified Mains Output (!! Mains Connected !!) to R7632105				
Pin Name	**Pin No**	**In/Out**	**Description**	**Signal**
MAINS_IN	1	O	Mains Input Voltage	0-360V
MAINS_IN	2	O	Mains Input Voltage	0-360V
MAINS_IN	3	O	Mains Input Voltage	0-360V
MAINS_RET	4	O	Mains Input Return	-0.2 to 0V
MAINS_RET	5	O	Mains Input Return	-0.2 to 0V
MAINS_RET	6	O	Mains Input Return	-0.2 to 0V
Vac	7	O	Rectified Mains Voltage	0-360V
+380V	8	I	+380 V (to SMPS on R7632113)	+380V
GND	9		Primary Ground	-
GND	10	O	Primary Ground	-
++15VM	11		Rectified Voltage	++15VM

Connector: J603 Controls				
Pin Name	**Pin No**	**In/Out**	**Description**	**Signal**
TRAFO_RANGE	1	I	Lamp Voltage Range Select	0-5V
FAN_SPD	2	I	Fan Speed control	0-5V
BOOST_ON	3	I	Boost Enable Voltage	0-5V
TEMP_RECT_SEC	4	O	Temp Sense Heatsink Sec Rectifier	0-5V
TEMP_TRAFO	5	O	Temp Sense LPS Trafo	0-5V
VS	6	O	Lamp- Voltage Sense Voltage	0-5V
IS	7	O	Lamp-Current Sense Voltage	0-5V
SMPS_OK	8	O	HIGH IF LV SMPS IS OK	0-5V
FAN_OK	9	O	HIGH IF FANS OK	0-5V
++15V	10	O	Rectified Voltage	0-5V

Connector: J603 Controls				
Pin Name	**Pin No**	**In/Out**	**Description**	**Signal**
GND	11	-	Secondary Ground	
GND	12	-	Secondary Ground	

15.8 Adjustments on Board

Location of the Adjustment Controls

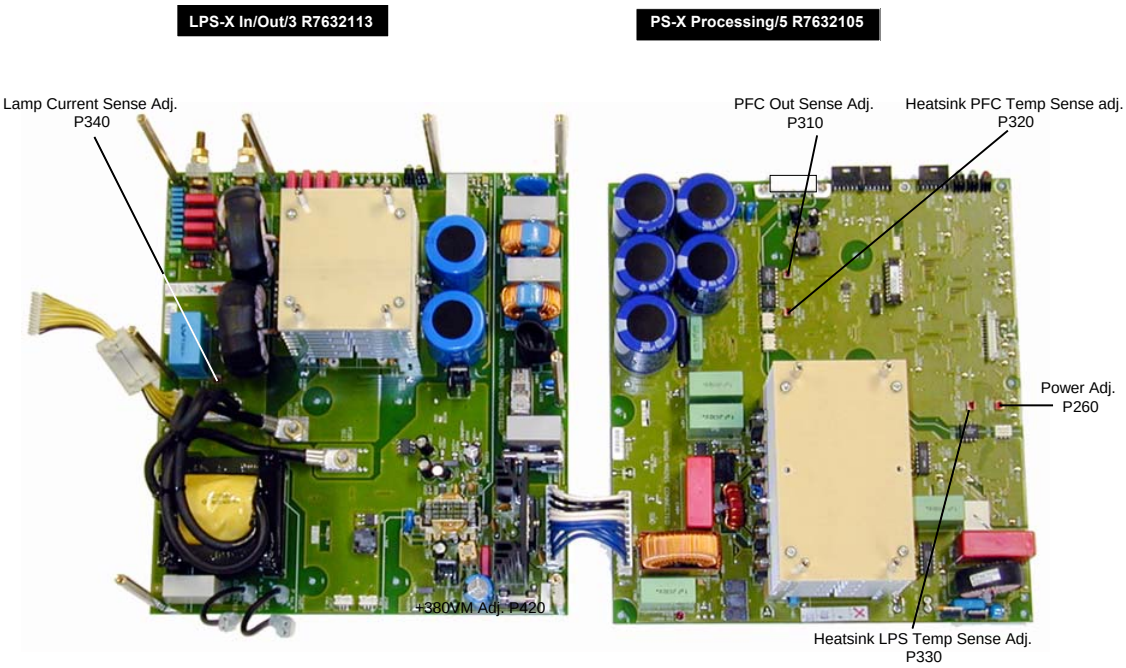


Image 15-15
Adjustment controls on LPS

WARNING

Special Equipment is required for the alignment of the different adjustment controls on the Lamp Power Supply. For that reason, NEVER attempt to re-adjust the different adjustment controls in order to maintain the factory-preset performances and to prevent damage to other connected electrical circuits.

16. START PULSE GENERATOR (SPG) R763512

16.1 General Info

View of the SPG

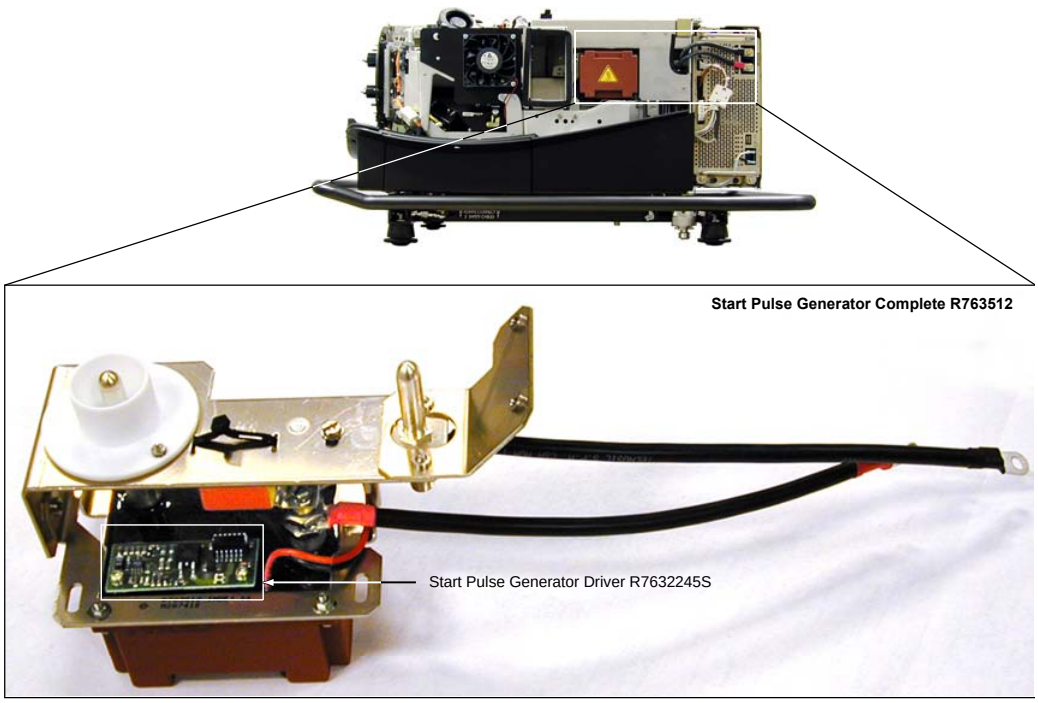


Image 16-1
View of the SPG

Purpose of the SPG

The purpose of the Start Pulse Generator (SPG) is to ignite the lamp with a burst of high voltage peaks. The SPG superimposes high voltage peaks onto the normal dc start-up voltage of the lamp supplied by the Lamp Power Supply. Once the lamp is started up and burning the high voltage is removed and the lamp voltage drops to the arc voltage.

The high voltage peaks are added to the lamp voltage by a superimposing transformer which is in series with the positive connection from the LPS to the lamp. The negative connection from LPS to lamp is direct and is connected to the chassis at the lamp side. The full lamp current passes through the secondary of the superimposing transformer.

16.2 Technical Info

Block Diagram

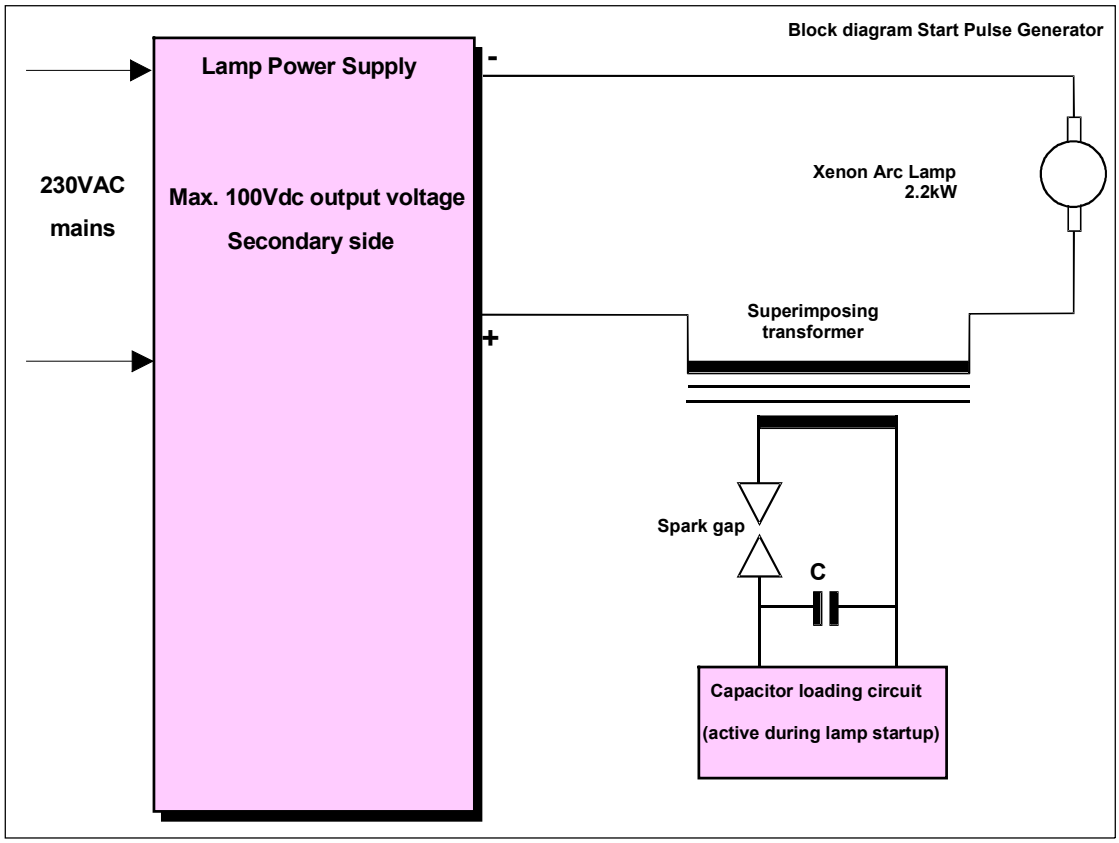


Image 16-2
Block diagram SPG

Technical Description

The transformer is triggered at the primary by a periodical discharge of a few high voltage capacitors (C5, C6, C7) through two spark gaps (SA1, SA2). This generates an energy pulse of a few megahertz. The voltage at the secondary is several times higher than the voltage on the primary.

The high voltage capacitors itself are charged by a Switched Mode Power Supply. All active components of the SMPS are on the subunit of the SPG.

At the beginning of a switching cycle the Mosfet Q1 it turned on. The current through Q1 and the primary of T1 ramps up, putting energy into T1. The HV diodes on the secondary are at that time off. The current is measured by resistors R5 and R6. When it reaches about 5 A the control IC I1 switches Q1 off. The energy stored in T1 is now charging C5, C6 and C7 via a current through D3.

The capacitor C4 and the diode D2 form a clamping circuit for the high voltage peaks on the secondary of T1. The capacitor C4 is charged through D2 at the beginning of the on period of Q1. To limit the peak current at that time, L1 is added. Because L1 would generate a high voltage when Q1 is switched off, a snubber network formed around D1, R1 and C3 is also added.

The IC1 is a low power current mode PWM IC (Pulse Width Modulation). It is activated when the lamp voltage reaches about 85V. This is the minimum dc lamp voltage for igniting the lamp. The moment the lamp voltage drops below this voltage, it means the lamp is ignited and the IC is disactivated.

Detection of the lamp voltage is done by Q2 and Z1. When the voltage across R10 becomes higher than the zener voltage, Q2 begins to conduct and delivers power to IC1.

A turn-on delay of about one second is added by the network C4, R2 and D1 to make sure the dc lamp voltage is stabilized.

The switching frequency is determined by R1 and C5 and is set at about 12.5kHz. D2 and D3 protect the circuit against reversed polarity.

Pin assignment connector

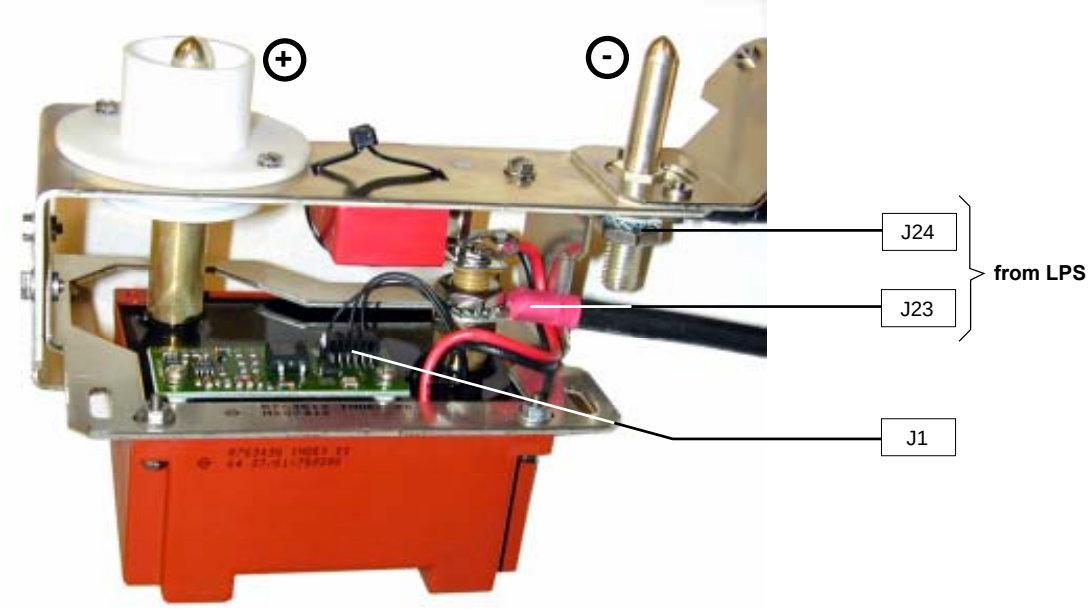


Image 16-3
Pin assignment connector J1

Connector: Lamp Power Cables				
Pin Name	**Pin No**	**In/Out**	**Description**	**Signal**
LMP_OUT_POS	23	I	Positive lamp voltage from LPS	Red wire
LMP_OUT_NEG	24	I	Negative lamp voltage from LPS	Black wire

Connector: J1 SPG Driver				
Pin Name	**Pin No**	**In/Out**	**Description**	**Signal**
LMP_OUT_POS	1	I	Positive lamp voltage from LPS	
	2			
LMP_OUT_NEG	3		Negative lamp voltage from LPS	
	4			
	5			
SPG_DRV	6		Connection to switching Mosfet	

17. SWITCH MODE POWER SUPPLY (SMPS) R764349

Attention

WARNING

THIS CIRCUIT BOARD IS HOT TO AC. THIS POWER SUPPLY, DOES NOT USE A LINE ISOLATION TRANSFORMER, MEANING A PORTION OF THE CIRCUITRY IS HOT-TO-LINE AND SHOULD BE TREATED WITH CAUTION.

Also When the mains is switched off, a period of at least 2 minutes must pass before unplugging the module for servicing

Image 17-1

17.1 Introduction

View of the SMPS

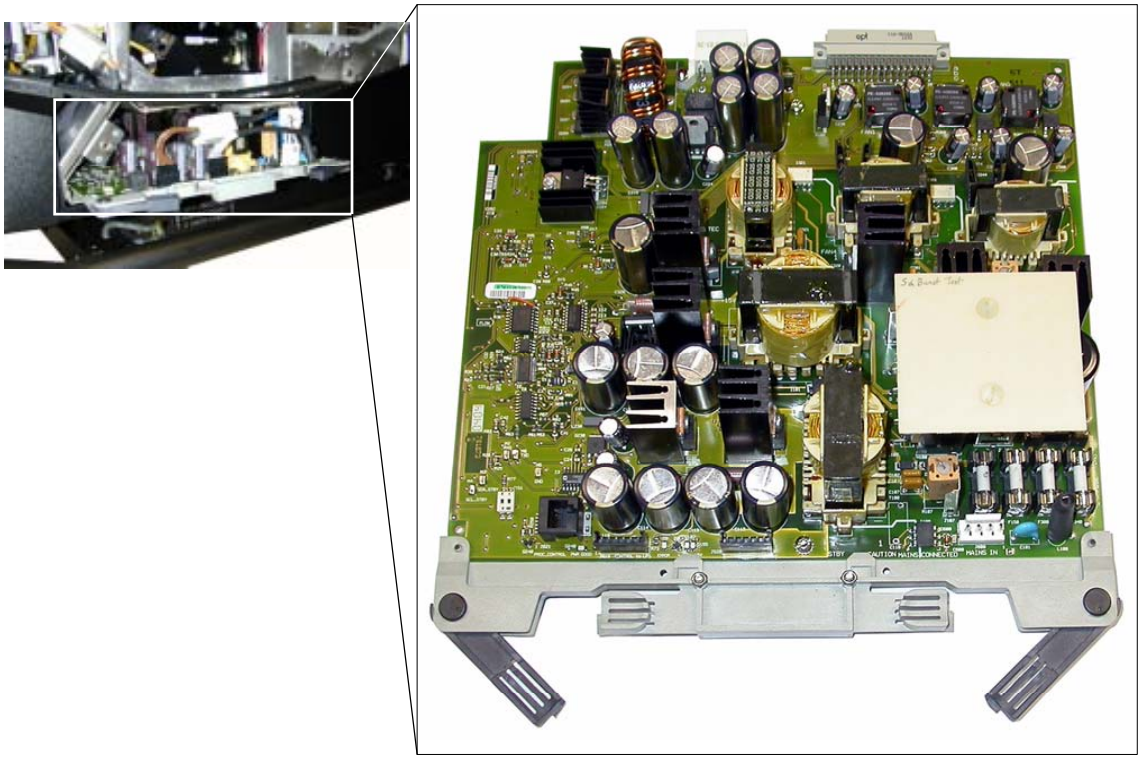


Image 17-2
View of the SMPS

17.2 Technical Description

General

The following functions are performed by this unit :

- Generation of the standby voltages for the controller and the interfacing.
- Generation of the “operational voltages” to the rest of the circuits (PMP, Formatter, etc...)
- Supply voltages and regulation of the speed of the fans and the TEC’s (Thermo Electric Cooler).
- Processing of a number of controls (like temperature sensors) and driving on and off the appropriated circuits by the use of a microprocessor.

Standby power supply

This is a separate Flyback Converter built around the I100 TOP249 and the transformer T100, running at approximately 132KHz.

The +380VM, arriving at J609 from the LPS board, is further smoothed by L100/ D100 / C102 .

The ++5V , from the Flyback Converter, is used in the controller, LPS interface and to generate the 3V3 for the controller on board. The ++30V ,from the Flyback Converter, is used in the interfacing circuits, motor control and Fan 1-2-3.

The status of this SMPS is shown with the green LED diode D107. By using the +5V as feedback, there is no further need to stabilise this ++5V on the CPU.

The drain in the TOP249 is protected by the snubber network D101/D102/C104/R107.

This Standby SMPS is active as soon the mains switch is turned on. The maximum power of this converter is 120W.

Power supply for the electronic circuits

This SMPS, built around the I150 TOP249 and the transformer T150, delivers one unique voltage +15V with a maximum power of 100W. This voltage is then further down converted by DC / DC converters to various other voltages.

The Flyback Converter is switched On and Off via the opto-coupler I151, on its turn driven by the SHDN_SMPS (SHut DowN) line from the microprocessor I2 (port P1.7, pin 4).

This +15V power supply is utilised by the operational modules in the projector.

Following down converted voltages are obtained by DC/DC converters:

The+3.3V- PMP and Formatter board (driver of the DMD units, between PMP and DMD).

The IC I200 (LT1339) drives the two parallel power FETs Q202/Q203 in the bottom (BG output) and Q204 is driven by the TG (Top Gate) output of the IC. The total required current by the PMP and formatter is approximately 24A.

The current sensing resistors R211/R212/R213 limit the output current in the event of a short or very heavy load.

The Voltage feedback happens through R214, R215/R216 and R217 to pin 9 I200.

The power voltage+30V and the power voltage +5V

If the +15V is existing, the ++30V is switched through by Q230 and acts further as the +30V power voltage. The maximum output current totals 0.5A.

The same voltage switches also the ++5V via Q233/Q232 and acts further as the +5V power voltage. The maximum output current totals 7A.

The +12V- Formatter, Motor drive PMP.

The +15V is also applied to the stabilizer IC I230, supplying a stable +12V power voltage. The maximum output current totals 1A.

Voltage monitoring

The mains voltage is constantly monitored in order to have an immediate reaction and to put the mirrors in their parking position as soon the mains voltage would disappear.

The V_SIN (half wave rectified mains input voltage) , taken from the mains input, is coupled by an opto-coupler I190 to the voltage comparator I240. As long the pulses can switch on the opto-coupler, the voltage at pin 10 remains below the threshold installed by the zener Z240.

The output "PWR_GOOD line (active low= Error)” can equally be pulled low by the output of two other voltage comparators (+3V3 and +5V). These two level detectors are constantly checking whether these voltages still are present or at least not too low.

The status of the PWR_GOOD line is shown by the YELLOW LED D240 This LED is on when all voltages are OK.

The local uProcessor with flash memory and I²C interface on board performed the following functions:

- Measurement of the ambient temperature T_AMB and the lamp house temperature NTC_LAMP.
- Switching on and off of the fans and variation of their speed in function of the measured temperature via the different SHDN_xx and VDAC_xx connections.
- Speed control of the FANs around lamp cathode and light engine via FAN_4_CTRL, FAN_2_CTRLand FAN_5_CTRL.
- Control of some protections, including:
  - lamp house fully plugged in via MICR_SW. (Micro switch : switch that senses the position of the lamp house block. It must be fully pushed in the holes before you can start up.)
  - tilt of the projector, (in fact, position of the xenon lamp) via TILT_SW. (Tilt switch : The xenon lamp must be in a well defined position for maximum lifetime. Because the position of the lamp is determined by the position of the projector a “tilt unit “ mounted on the metal frame below the lamp house is checking the position of the projector. If the projector is installed in the wrong position, the SMPS cannot start up.
  - absence of mains voltage via V_SIN.
  - T° sensors plugged in ?
- Adjustment of the voltages for the Peltif the DMD’s.
- Switching on and off of the operational SMPS (+15V).
- Enabling and disabling the protections.
- Loading the LUT’s (conversion of the measured temperature to the speed of the fans).
- Voltages Fan 1,2 & 3 – +30V, +15V, +12V, +5V & +3V3 (multiplexed by I9).
- Fan speed of Fan 4,5 and 2 (multiplexed by I8)

The lamp temperature related voltage is buffered with I1(3-2-1) , converted in the AD Converter I7 to a digital information and then further processed using LUT’s by theprocessor. In case of a too high temperature the processor switches off the SMPS. In order to switch off the LPS as well, the ERROR line is pulled low via Q3.

As a safety measure, in the unlikely event the µP fails, the lamp temperature information is applied straight forward to a level detector I1(5-6-7) . Q2 takes over in this case to pull the ERROR line to an active low state.

Outputs of the local processor:

- SHDN_0 ... 3 lines : switching on and off the four fan groups.
- SHDN_TEC : switching on and off the SMPS for the Peltier cooling.
- SHDN_SMP : switching on and off the operational SMPS (+15V).
- I²C bus for communication with the main processor (pins 7 -8).
- local I²C bus for the E²PROM (I5) and AD Converter (I8).
- data and clock for the local DAC.

The VDAC outputs are controlled by the processor in function of the measured temperature.

The Peltier voltage is programmable. The processor can switch this voltage on and off only. The temperature of the DMD ‘s is sensed and the voltage is applied to the TEC’s from 40°C onwards. It switches back off at 30°C.

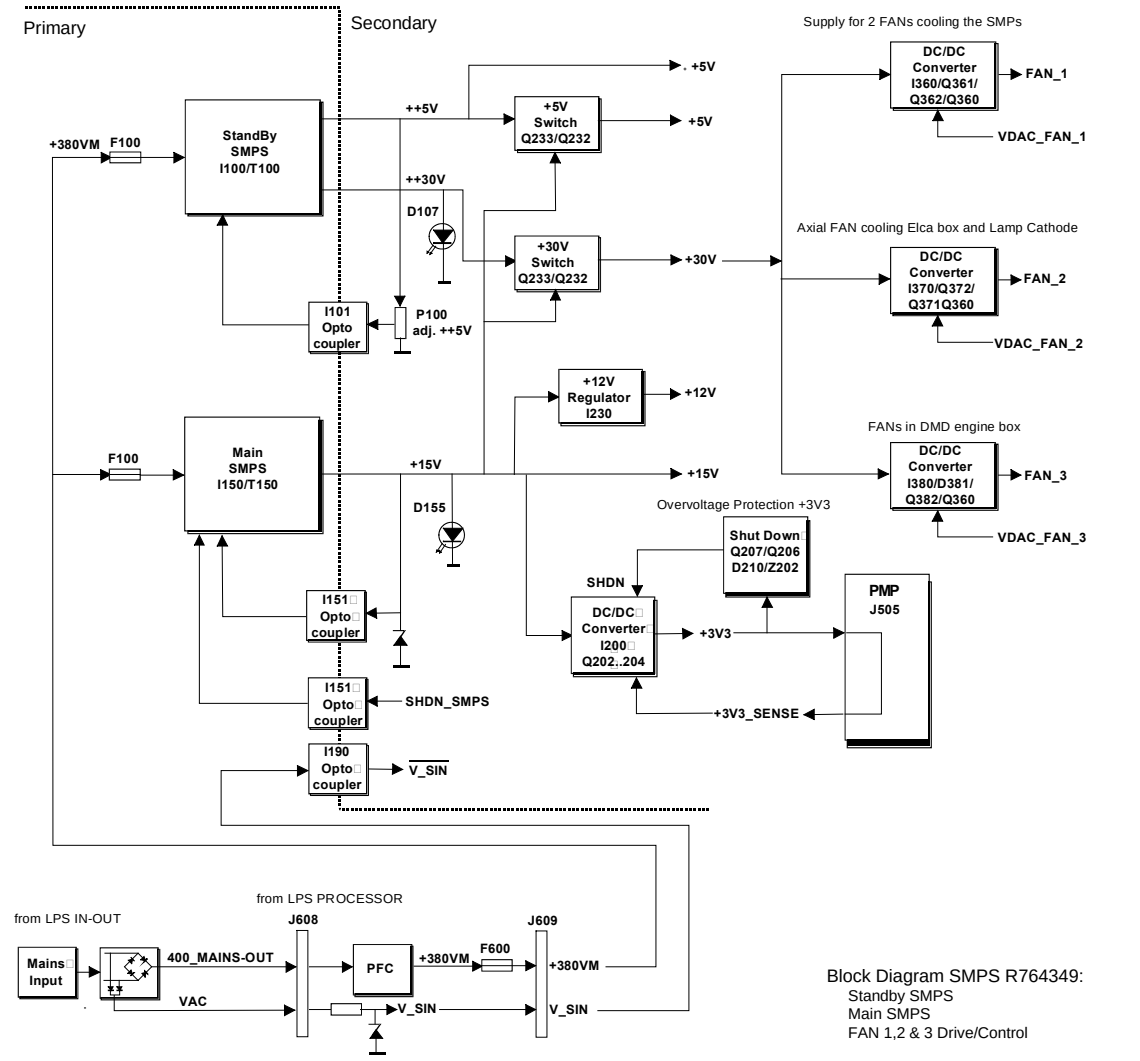
Power Voltage for the Fans

In total 5 adjustable Fan outputs are available:

- 2 Flyback converters (built around T300/I300, and T340/I340) supply each of them a power of minimum 40W by an input voltage of +380V. The output voltage is adjustable between 12V and 28V. These outputs drive the FAN_LAMP and FAN_MIRR.
- 1 Flyback converter (built around T320/I320) supplies a power of minimum 90W by an input voltage of +380V. The output voltage is adjustable between 7V and 15V. This output drive the TEC (Thermo electric cooling).
- 3 DC/DC converters (built around I360, I370 and I380) supply each of them a power of approximately 30W by an input voltage of +30V. The output voltage is adjustable between 12V and 28V. These outputs drive the FAN_1, FAN_2 and FAN_3.

17.3 Block Diagrams

SMPS Power diagram



Block Diagram SMPS R764349:
Standby SMPS
Main SMPS
FAN 1,2 & 3 Drive/Control

Image 17-3
Power diagram

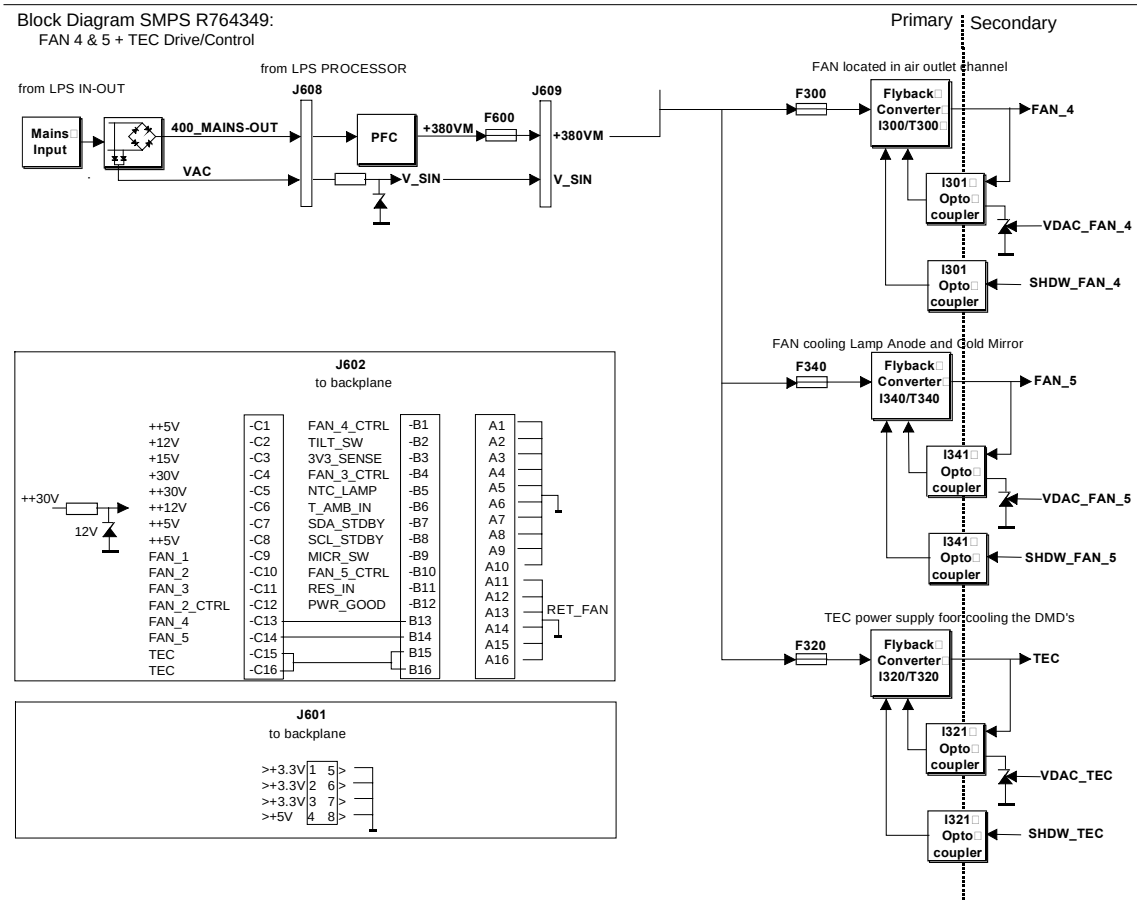


Image 17-4
Power diagram-FAN drive

SMPS Control diagram

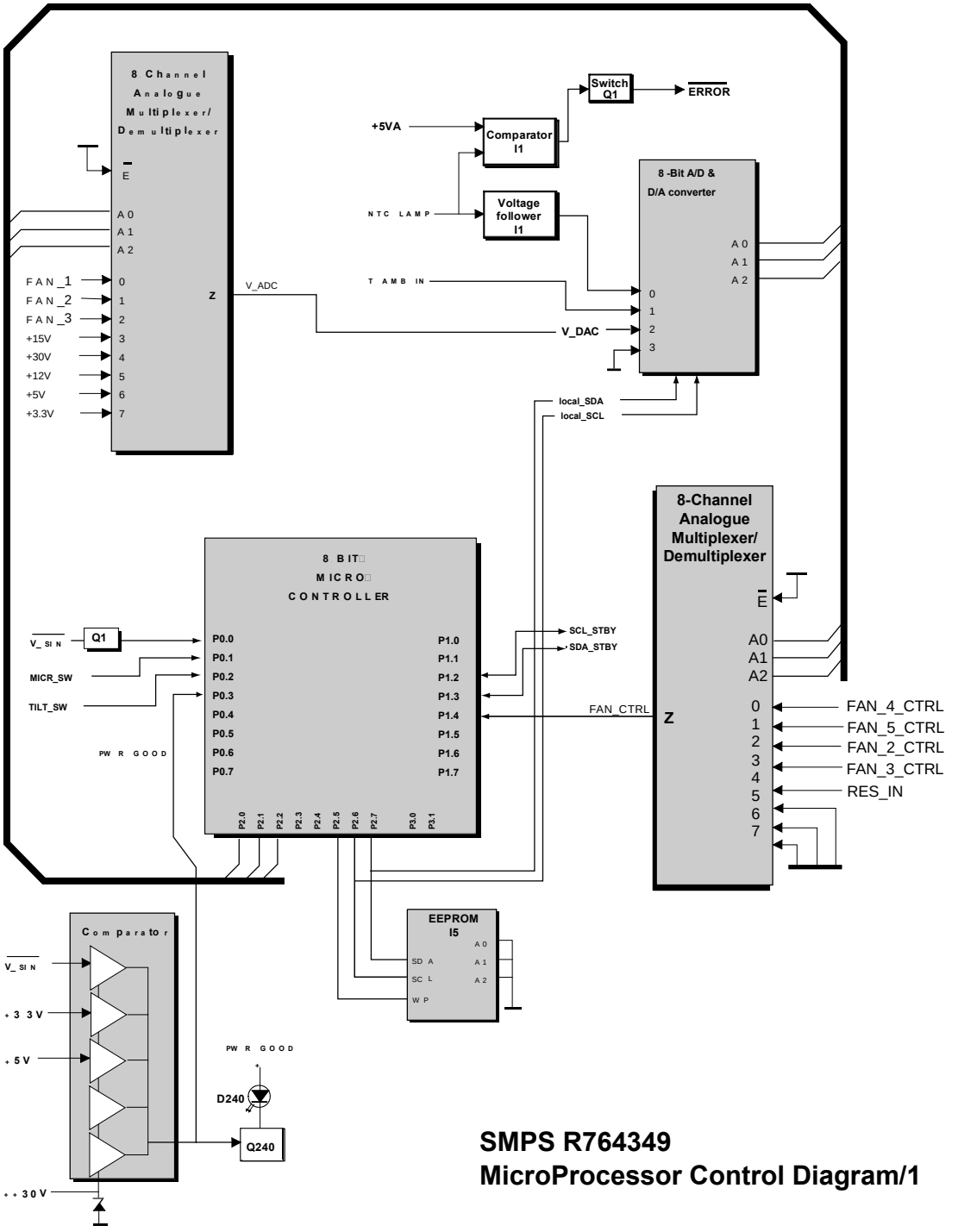


Image 17-5
SMPS control diagram-Inputs

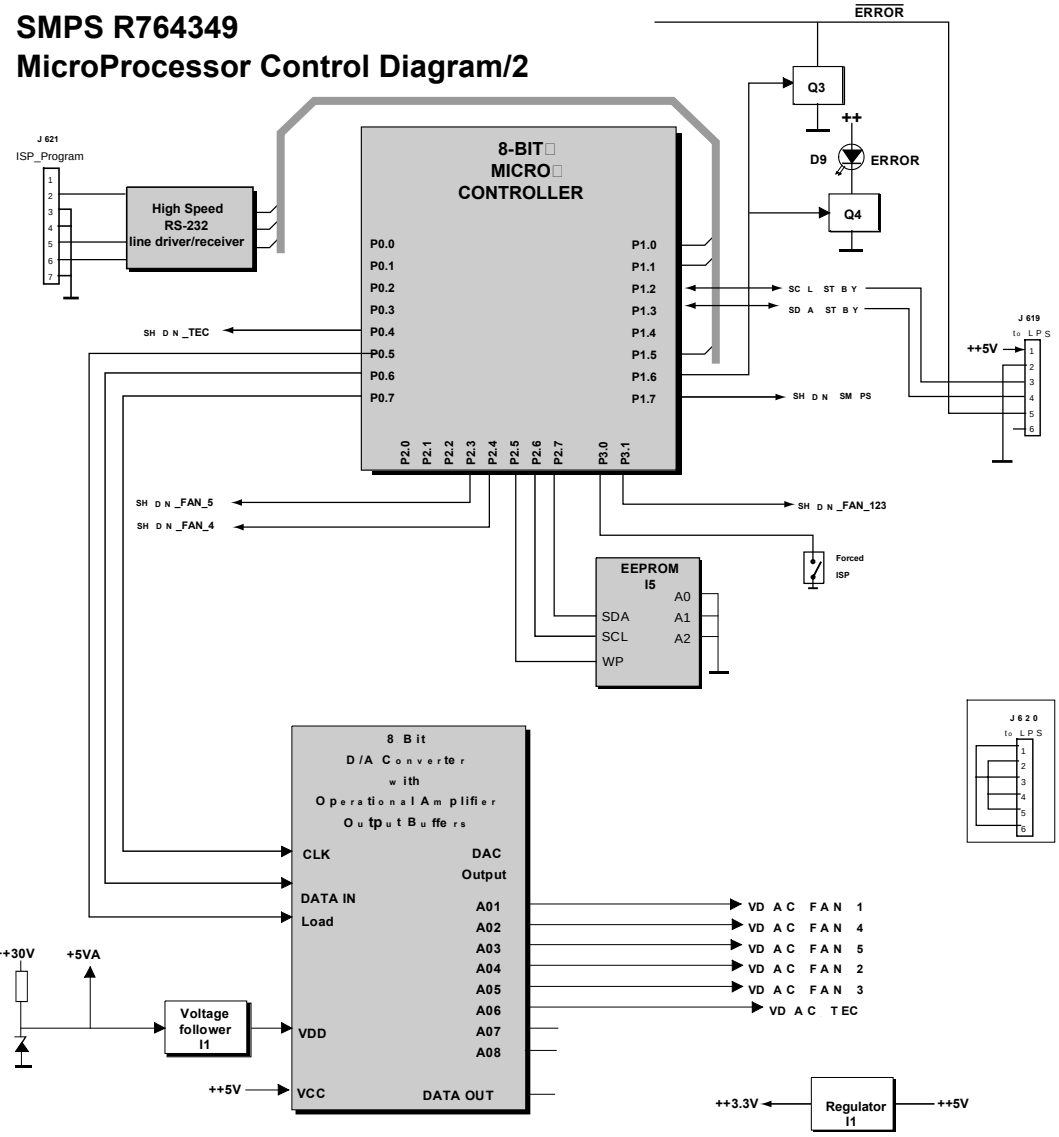


Image 17-6
SMPS Control diagram-Outputs

17.4 Pin Assignment Connectors on Board

Pin Assignment

Connector : J609 – to Lamp Power Supply (primary)				
Pin Name	**Pin No**	**In/Out**	**Description**	**Signal**
+380V	1	I	+380VM from PFC on LPS	+380V nom.
	2		not used	
VSIN	3	I	Full wave rectified mains supply, limited on 15V by a zener.	
GNDM	4		Earth (primary) of LPS	

Connector : J619 – to Lamp Power Supply (secondary)				
Pin Name	**Pin No**	**In/Out**	**Description**	**Signal**
++5V	1	O	+5V Power Supply StandBy	+5VDC
GND	2		Earth (secondary)	
SCL	3	I/O	Serial Clock line	0/5VDC
SDA	4	I/O	Serial Data line	0/5VDC
/ERROR	5	O	Drops to low level when the NTC sensor in Open collector drain the Lamp house exceeds predefined temperature range	Open collector drain
	6		not used	

Connector : J601 – to Backplane (secondary)				
Pin Name	**Pin No**	**In/Out**	**Description**	**Signal**
++3.3V	1,2,3	O	+3.3V Power Supply	+3.3VDC
+5V	4	O	+5V Power Supply	+5VDC
GND	5,6,7,8		Earth (secondary)	
GND	a..a10		Earth (secondary)	
RET_FAN	a11..a16	I	Tacho input Fan FAN_LAMP	
FAN_LAMP_CTRL	b1	I	Tacho input Fan FAN_LAMP	0/5VDC
TILT_SW	b2	I	Tilt Switch	0/5VDC
3V3_SENSE	b3/b4	I	Remote sense 3.3V	3.3VDC
NTC_LAMP	b5	I	NTC sensor input	0..5VDC
T_AMB	b6	I	Analog Voltage, measure for ambiant 0.1V/°C temperature	0.1V/°C
SDA_STBY	b7	I/O	Serial Data line	0/5V
SCL_STBY	b8	I/O	Serial Clock line	0/5V
MICRO_SW	b9	I	Microswitch	0/5V
FAN-MIRR_CTRL	b10	I	Tacho input Fan FAN_MIRROR	0/5VDC
RES_IN	b11	I	Spare input	0/5VDC
PWR_GOOD	b12	O	Signal that indicates the presence of the mains voltage and that the power voltages+3.3V and +5V are within predefined range.	
FAN_LAMP	b13	O	Current output to FAN Lamp	16...28VDC
FAN_MIRR	b14	O	Current output to FAN Mirror	16...28VDC
TEC	b15,b16	O	Current output to Thermo electric cooling	+9...+16VDC
++5V	c1	O	5V StandBy output	+5VDC
+12V	c2	O	12V output	+12VDC
+15V	c3	O	15V output	+15VDC
+30V	c4	O	30V output	+30VDC
+12V AMB	c5	O	12V output to Ambiant Temp. Sensor	+12VDC

Connector : J601 – to Backplane (secondary)				
Pin Name	**Pin No**	**In/Out**	**Description**	**Signal**
++30V	C6	O	30V Standby output	+30VDC
SHDN_RES	c7/c8	O	Spare output On/Off	0/5VDC
FAN_1	c9	O	Current output to FAN 1	12...28VDC
FAN_2	c10	O	Current output to FAN 2	12...28VDC
FAN_3	c11/c12	O	Current output to FAN 3	12...28VDC
FAN_LAMP	c13	O	Current output to FAN Lamp	12...28VDC
FAN_MIRR	c14	O	Current output to FAN Mirror	12...28VDC
TEC	c15/c16	O	Current output to Thermo electric cooling	+9...+16VDC

Connector : J620 – Address from Lamp Power Supply (J618) (secondary)				
Pin Name	**Pin No**	**In/Out**	**Description**	**Signal**
	1-3-6		Interconnected	—
	2-4-5		Interconnected	—

17.5 Status Conditions/Fault Analysis

LEDs and Fuses on Board

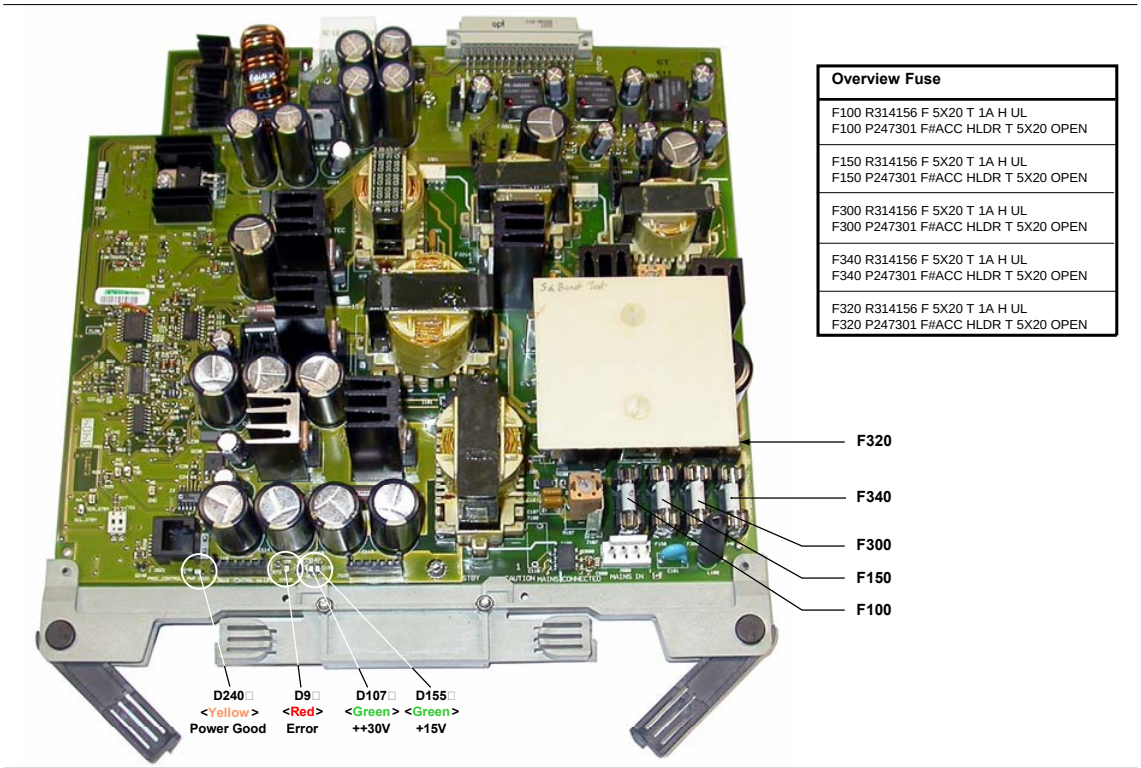


Image 17-7
Status LEDs and FUSES on board

LED	Explanation
Green LED D107	Illuminating: indicates the presence of the ++30V
Green LED D155	Illuminating: indicates the presence of the +15V
Yellow LED D240	Illuminating: indicates the presence of the mains voltage and that the power voltages +3.3V and +5V are within predefined range.
Red LED D9	Illuminating: indicates an ERROR condition, e.g. • Overheating detection in lamp house. • FAN Lamp or FAN Mirror failure • Lamp unit not connected • Tilting error of the projector • Failing of secondary power voltages SMPS

18. TEMPERATURE & MOTOR CONTROL MODULE R764203

18.1 Introduction

View of the Temperature & Motor Control Module

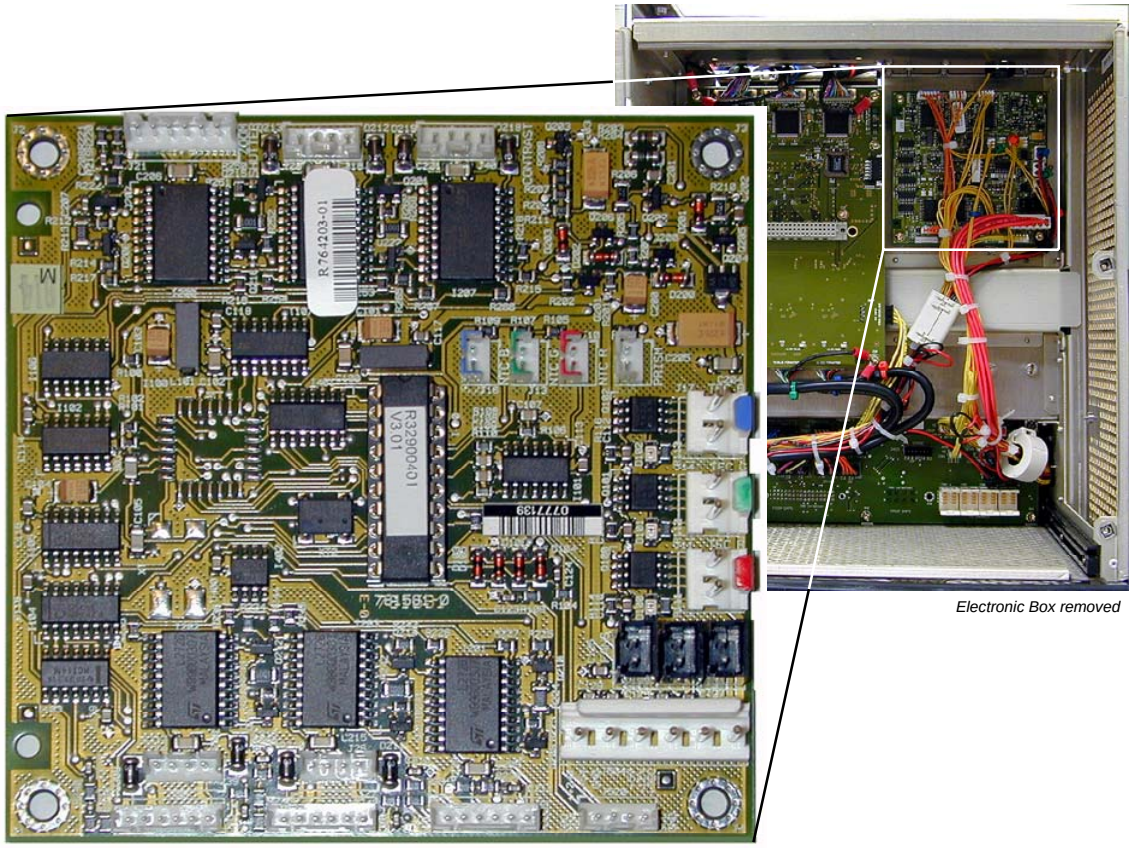


Image 18-1
View of the Temperature & Motor Control Module

18.2 Technical Description

General

This board performs two different functions:

- Temperature control of the DMD devices.
- Drive of the motors.

The command and control lines are software controlled and a local micro-controller communicates, via the I²C bus, with the main CPU. An NTC resistor measures the temperature of the DMD and an active Pelletier-cooling element is switched on when a certain temperature is reached. The active cooling status of each Pelletier device is visualized with yellow Leds.

The zoom and focus motors have an encoder so that their position can be precisely adjusted. This can be necessary to get an exact position of the zoom and focus lenses per source. The other motors have a simple left/right or up/down control with an end of range detection. They are driven with a dual power OPAMP.

Micro-Controller Section

The board has two wired connections with the Power Backplane, J520 for the connection with the CPU (I²C bus and an IRQ_DMD) and J504 with a number of supply voltages.

The +TEC voltage is generated and adjusted on the SMPS and is applied via a MOSFET power switcher to the Pelletier active elements.

An 8-bit micro-controller P87LPC768P is slaved to the CPU via an SDAI and SCLI bus. In the event of a cooling problem with heavy risk of damaging the DMD's, an IRQ_DMD line informs directly the CPU to shut down the projector.

Some data are programmable, like start and stop conditions of the DMD cooling, and this data is programmed via the micro-controller into the E²PROM I402 using its own local I²C bus SCL0/SDA0.

The temperature of each DMD is measured with an NTC resistor and the analog informations NTC1/2/3 are converted into a digital value in the controller. The result is compared in a LUT (Look Up Table) with a pre-installed and programmed value. The Pelletier elements are switched on from some threshold level onwards and switch off again as soon a working temperature is obtained.

The DMD's are also permanently cooled by fans running at a constant speed (J12, J15, J18).

As the micro-controller does not have sufficient I/O pins, an 8-bit addressable latch 74HC259 (IC401) is used. As the RESET or CLEAR pin is permanently high level, the IC only can work in the "Memory" and "Addressable Latch" modes. Three address bits A0/A1/A2 select one of the eight latches and the DATA IN information is then transferred to the addresses latch in the "addressable latch" mode when the ENABLE_259 is low.

Three latched TEC1/2 and /3 outputs turn Q100, Q101 and Q103 on when needed. A yellow LED visualizes the active status of the cooling element. The amplitude of the +TEC voltage is programmed on the SMPS board where this voltage is generated.

Three other outputs MUX0/MUX1/MUX2 are used for the 1 of 8 data multiplexers I104, I105 and I107.

Multiplexers I104 and I105 are an extension of the micro-controller. The encoder data of the zoom and focus motors are taken in by the controller via the Schmitt trigger-inverter I103 and the multiplexers I104/I105.

PRISM protection

The projection lens might be turned in by the zoom motor so far that the lens body could touch the DMD prism. Lens or Prism can be then be damaged. A sensor, connected to J20, detects this extreme position of the lens and the micro-controller stops the motor and even reverses the rotation to push it a little back, away from the prism.

Note that there is room for more encoder motors, but CHA2/CHB2 and CHA3/CHB3 are not used (see bloc schematics).

Motor Drive - Control

There is a common circuit for generation of the required motor current PWR_DRV. The current flows through Q204/Q205 as long Q202 remains blocked.

This circuit is initialized at power start up by C200/R201/Q200/Q201. These transistors are switched on a short time until C200 has charged up.

The RST_LOG is passing a Schmitt trigger-inverter of I102 and enables the de-multiplexer I107.

The power circuit of each motor is identical. A series transistor in the power rail is turned on to supply a dual power OPAMP L2726.

A voltage, fixed by R215/R218, installs a level at the "+" or the" -" input. The FWD and REV lines allow thereby a current flow in the motors in two directions.

Overload:

The motor current is flowing in R203/R204 and in the event of an overload, the voltage drop across these resistors reaches the 0.5V threshold and Q202 turns on. The collector current of Q202 charges C203, Q205 gets opposite biased due to the voltage drop across R210 and finally Q203 turns on.

The OVL line goes low, but this line is not used (anymore) as the micro-controller always gives a "Reset Overload" by pulling low the OVL_RST line, prior to start a motor (even when there is no overload). The OVL_RST line is a latched output of I401.

Shutter2

The SHUTTER2 motor is related to the Contrast Enhancement in the menu. A mechanical shutter (Iris) is inserted in the relay optics between the integrator rod and the folding mirror to improve the contrast. However, the light output decreases as a consequence.

DMD Temperature Control

A TEC (Thermo-Electric Cooler) is a solid state heat pump that utilises the Peltier effect. During operation, a DC current flows through it, causing heat to be transferred from one side of the TEC to the other, creating a cold and a hot side.

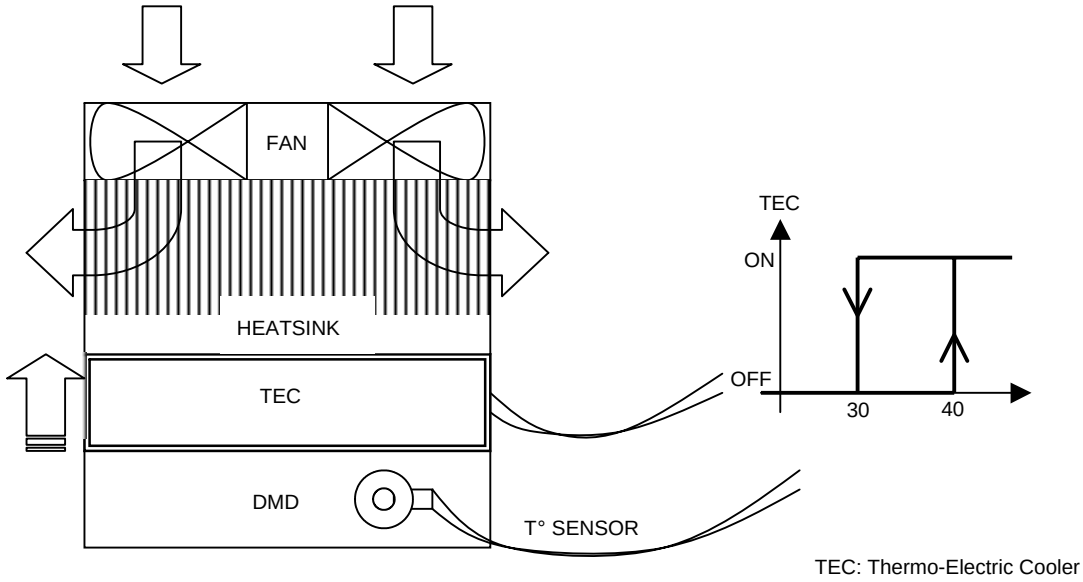


Image 18-2
DMD temperature control

Each DMD is mounted on a metal stud on which there is a TEC , a heatsink and a fan. An NTC-resistor in a voltage-divider circuit gives the temperature on the stud.

When this temperature rises above a threshold, the TEC is turned on. This way the heat of the DMD is transferred to the heatsink. When the temperature on the stud has dropped enough, the TEC is turned off again. An LED reflects the activity of the TEC.

A fan continuously blows air through the heatsink to cool it.

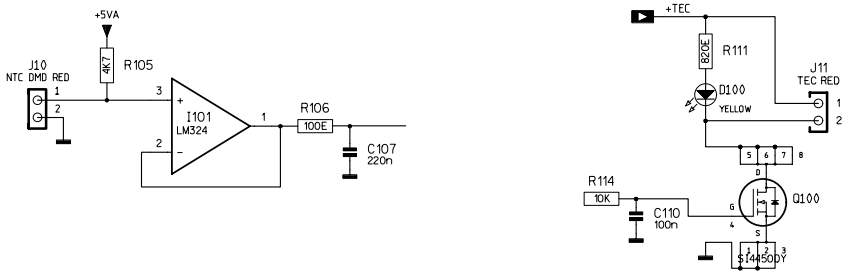


Image 18-3
TEC drive

Lens motorisation

Each motor is driven with a separate power stage, supplied however by a common current limiting circuit. One stage at a time is selected with the appropriate signal from a multiplexer.

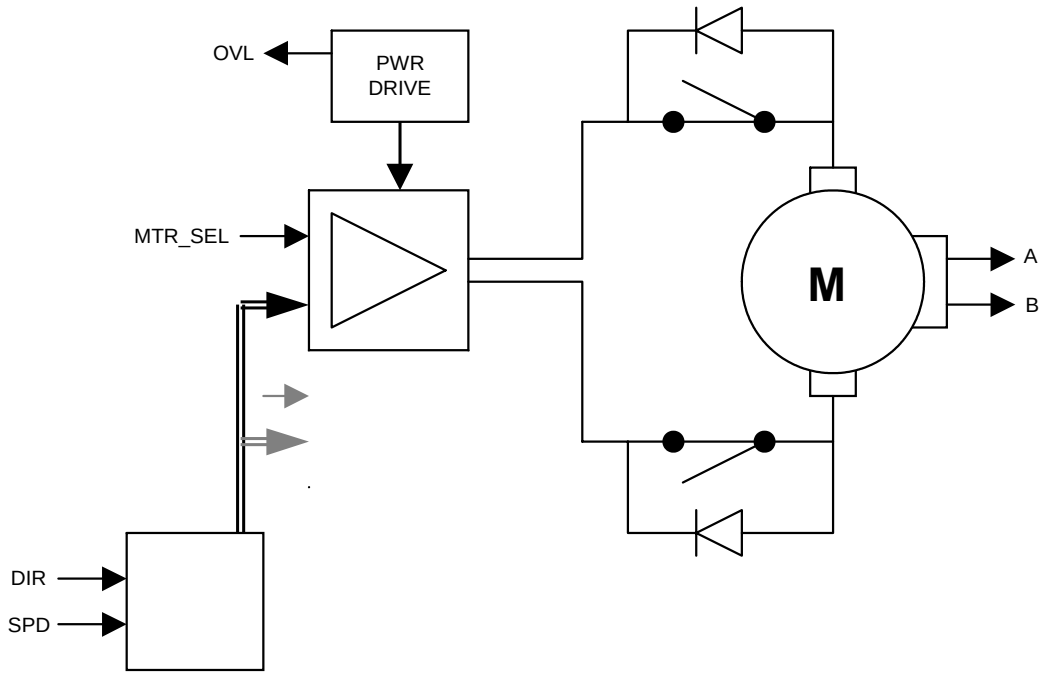


Image 18-4
Motor drive

Two controlling signals are formed out of a direction signal and a speed signal. The latter is a PWM-signal that can reduce the velocity of the motor by decreasing the duty-cycle. A switch at each end of the run will break the circuit and stop the motor but a diode still enables the reverse direction. The current limiting circuit prevents the motor from overheating during an overload situation. If this persists for more than three seconds then the current supply will be removed. This status can only be reset by selecting the other direction or a different motor.

Motors with encoder issue two phase-shifted signals, which can be used to increment or decrement a counter, thus keeping track of the relative position.

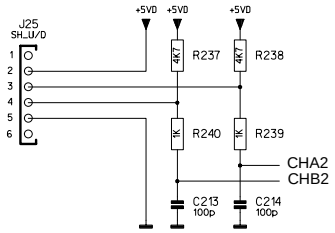


Image 18-5
Motor drive

PWM = Pulse Width Modulation: fixed frequency, varying duty-cycle (high/low ratio)

Controller

The voltages from the temperature-sensing circuits are converted with 8-bit ADC's. These values are then used to turn on/off the proper TEC-signals, and can be read out by the processor. When a DMD goes out of its operating temperature range for more than two seconds, an interrupt request will be sent out to the processor in order to take actions to prevent damage of the DMD.

When receiving a motor command, the motor-selection and direction-signals are set and the duty-cycle of the speed-signal leaves its zero-state. If the motor-command differs from the previous one then the overload-circuit will first be reset. An overload-signal indicates the current-limiting status. The motor-selection-signals are also used to control the multiplexers for the encoder-signals, so that only the position of the selected motor is considered

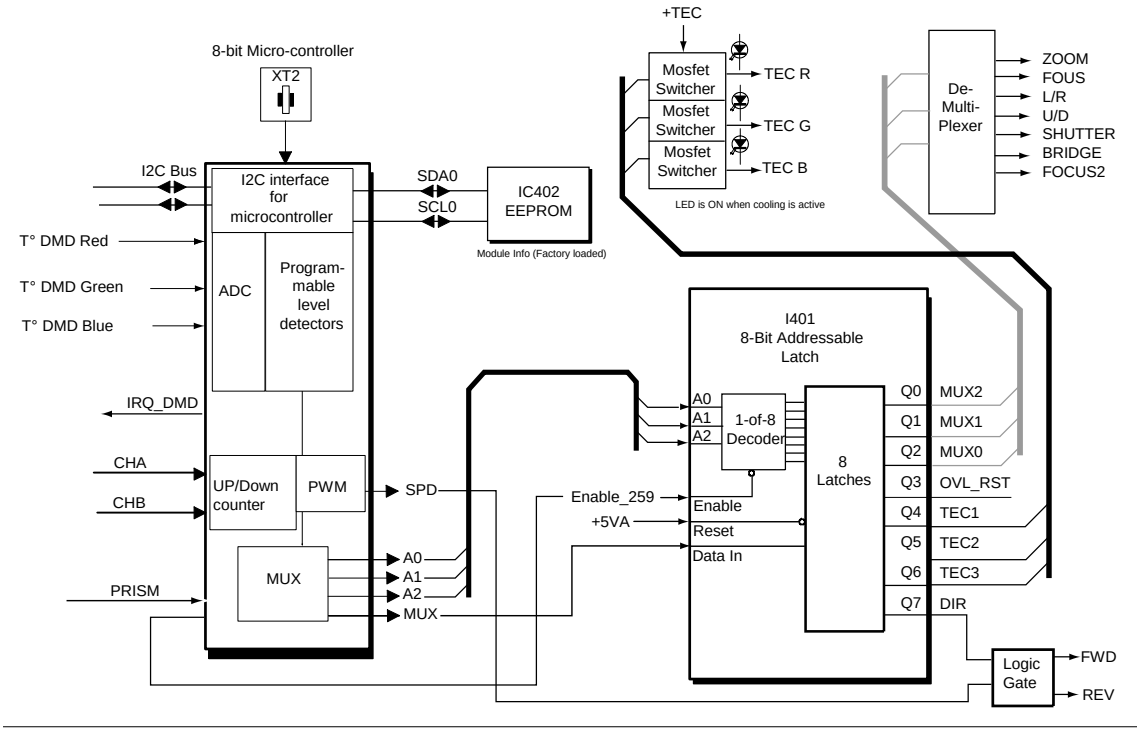


Image 18-6
Temperature/Motor Control

18.3 Pin Assignment Connectors on Board

Indication Connectors on Board

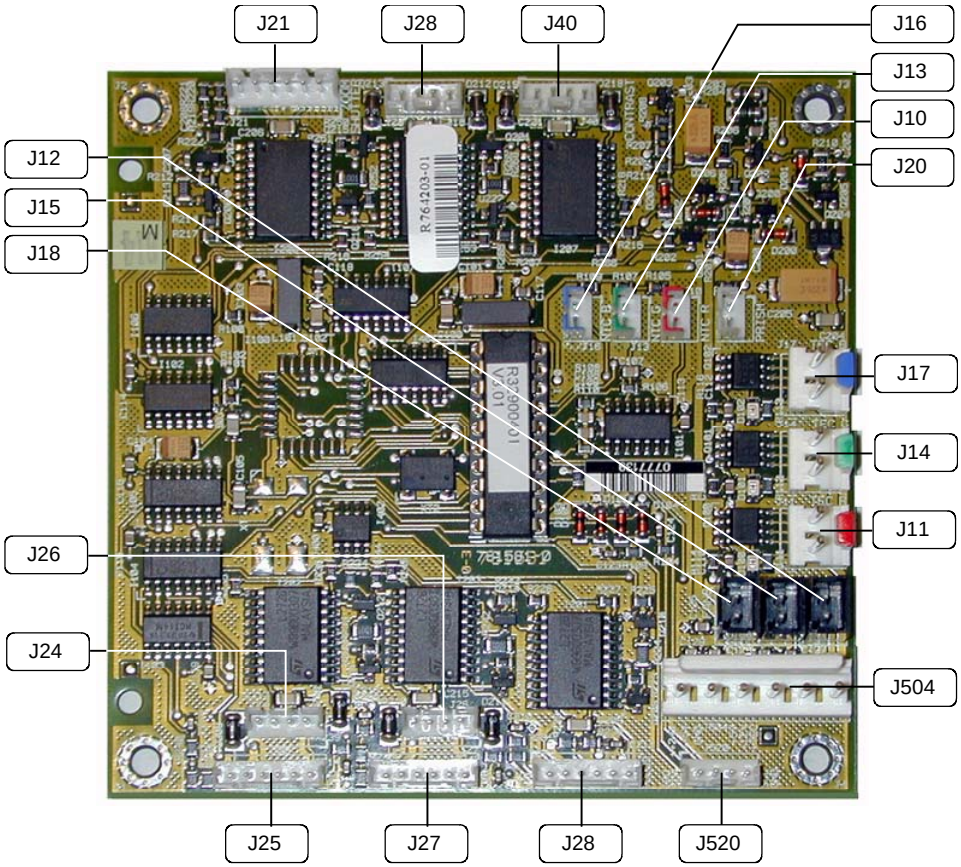


Image 18-7
Connectors on board

Connectors J25 and J27 are not used.

Pin Assignment

Connector : J504 From Power distribution backplane				
Pin Name	**Pin No**	**In/Out**	**Description**	**Signal**
+TEC	1	I	Voltage for the TEC's	max. 7A & 12V
+12V	2	I	Voltage for analog circuits & motors	400 mA max.
+5VD	3	I	Voltage for digital circuits	100 mA
GND	4		Ground	
++5V	5	I	Standby voltage digital	not used
++24V	6	I	Standby voltage analog	5 mA

Connector : J520 From Bckpln				
Pin Name	**Pin No**	**In/Out**	**Description**	**Signal**
IRQ_DMD	1	O	Interrupt request	max. 7A & 12V
SDA	2	I	I²C Data	400 mA max.
SCL	3	I	I²C Clock	100 mA
GND	4		Ground	

Connector : J10, J13, J16 NTC DMD Red, Green, Blue				
Pin Name	**Pin No**	**In/Out**	**Description**	**Signal**
NTC	1	I	pin 1 ntc resistor	
GND	2		Ground	

Connector : J11, J14, J17 TEC Red, Green, Blue				
Pin Name	**Pin No**	**In/Out**	**Description**	**Signal**
TEC+	1	O	+ terminal TEC	
TEC-	2	O	- terminal TEC	

Connector : J12, J15, J18 Fan Red, Green, Blue				
Pin Name	**Pin No**	**In/Out**	**Description**	**Signal**
+12V	1	O	FAN Voltage	
GND	2	O	Ground	

Connector : J20 Prism contact				
Pin Name	**Pin No**	**In/Out**	**Description**	**Signal**
P1.5	1	O	Membrane contact 1	
GND	2	O	Membrane contact 2 direction + diode	

Connector : J21 Zoom				
Pin Name	**Pin No**	**In/Out**	**Description**	**Signal**
Mtr Fw	1	O	Fwd motor terminal	
+5VD	2	O	Encoder voltage	
CHA0	3	I	Encoder Channel 0	
CHB0	4	I	Encoder Channel 0	
GND	5		Ground	
Mtr Rev	6	O	Rev motor terminal	

Connector : J23 Focus				
Pin Name	**Pin No**	**In/Out**	**Description**	**Signal**
Mtr Fw	1	O	Fwd motor terminal	
+5VD	2	O	Encoder voltage	
CHA1	3	I	Encoder Channel 1	

Connector : J23 Focus				
Pin Name	**Pin No**	**In/Out**	**Description**	**Signal**
CHB1	4	I	Encoder Channel 1	
GND	5		Ground	
Mtr Rev	6	O	Rev motor terminal	

Connector : J24 Shift Up/Down Shift				
Pin Name	**Pin No**	**In/Out**	**Description**	**Signal**
DRev	1	O	Endstop switch reverse direction + diode	Normally Closed
Rev	2	O	Endstop switch reverse direction	
Fwd	3	O	Endstop switch forward direction	Normally Closed
DFwd	4	O	Endstop switch forward direction + diode	

Connector : J26 Shift Left/Right Shift				
Pin Name	**Pin No**	**In/Out**	**Description**	**Signal**
DRev	1	O	Endstop switch reverse direction + diode	Normally Closed
Rev	2	O	Endstop switch reverse direction	
Fwd	3	O	Endstop switch forward direction	Normally Closed
DFwd	4	O	Endstop switch forward direction + diode	

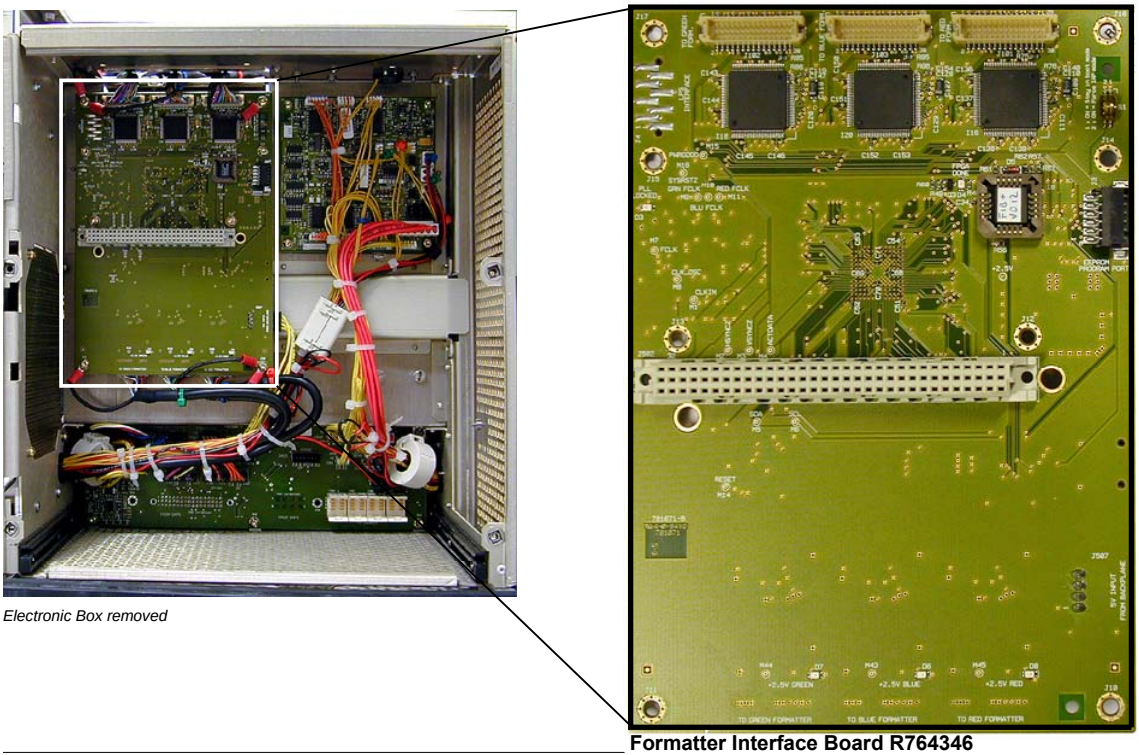
Connector : J28 Shutter				
Pin Name	**Pin No**	**In/Out**	**Description**	**Signal**
DRev	1	O	Endstop switch reverse direction + diode	Normally Closed
Rev	2	O	Endstop switch reverse direction	Normally Closed
Fwd	3	O	Endstop switch forward direction	Normally Closed
DFwd	4	O	Endstop switch forward direction + diode	Normally Closed

Connector : J40 Contrast (on light pipe)				
Pin Name	**Pin No**	**In/Out**	**Description**	**Signal**
DRev	1	O	Endstop switch reverse direction + diode	Normally Closed
Rev	2	O	Endstop switch reverse direction	Normally Closed
Fwd	3	O	Endstop switch forward direction	Normally Closed
DFwd	4	O	Endstop switch forward direction + diode	Normally Closed

19. FORMATTER INTERFACE BOARD (FIB) R764346

19.1 Introduction

View of the Formatter Interface Board



Electronic Box removed

Formatter Interface Board R764346

Image 19-1
View of the Formatter Interface Board

19.2 Power Supply

From SMPS via Power Distribution Backplane (+5V)

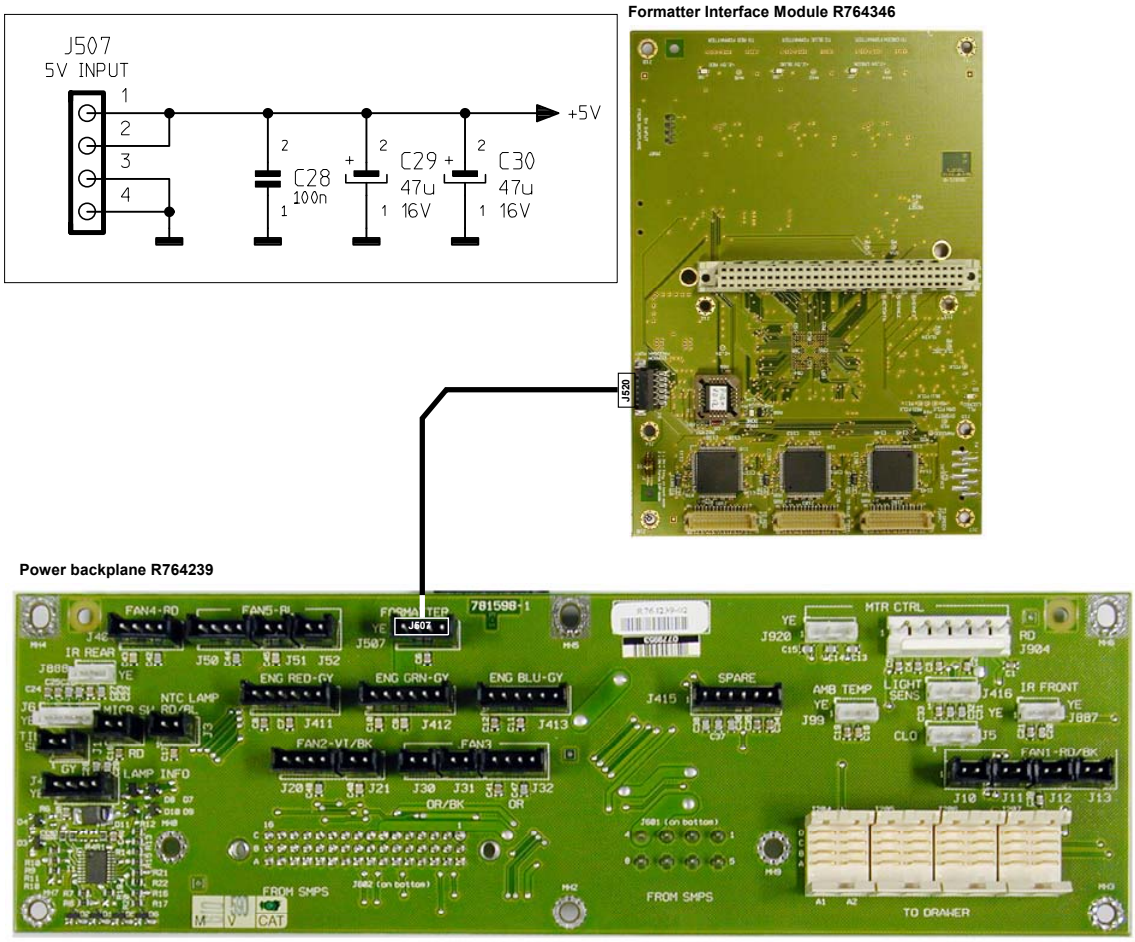


Image 19-2
+5V Power Supply

From SMPS via Pixel Map Processor (+3.3V)

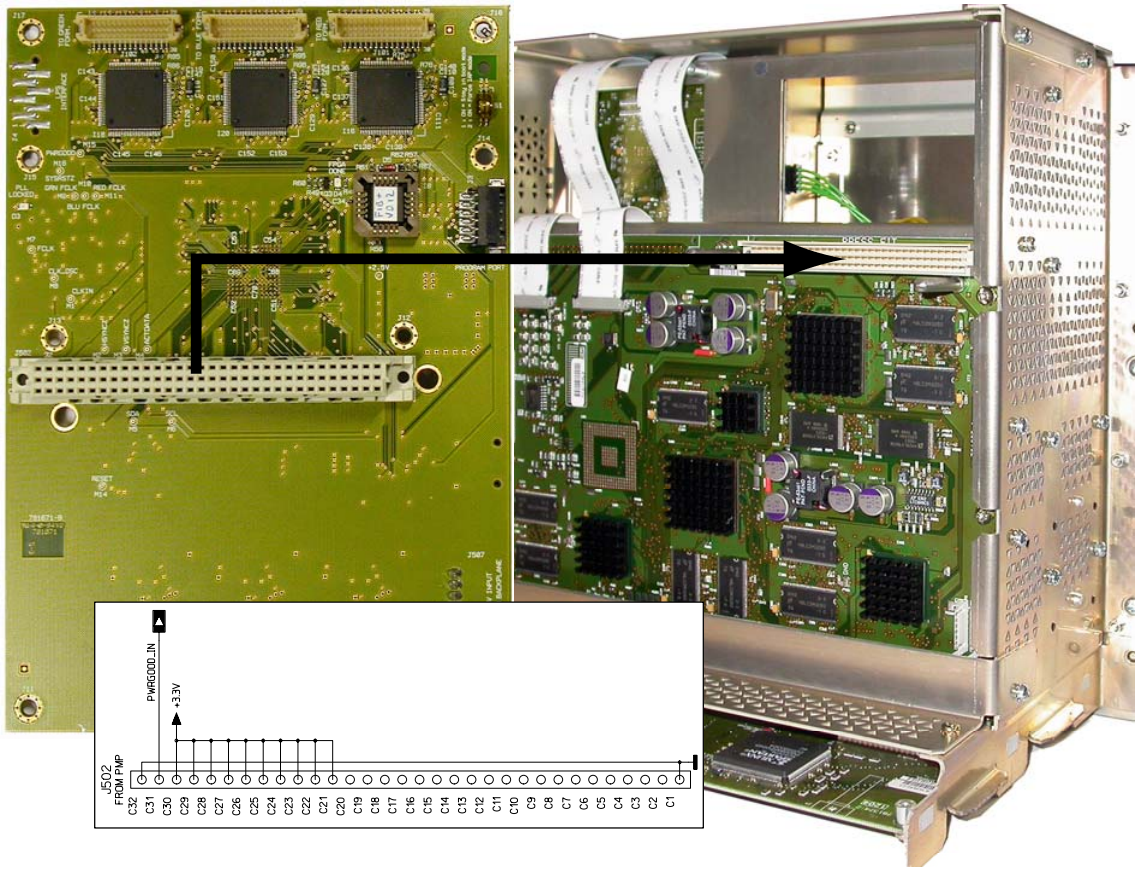


Image 19-3
3.3V Power Supply

19.3 Light Engine Connection

Power Supply to DMD Formatters

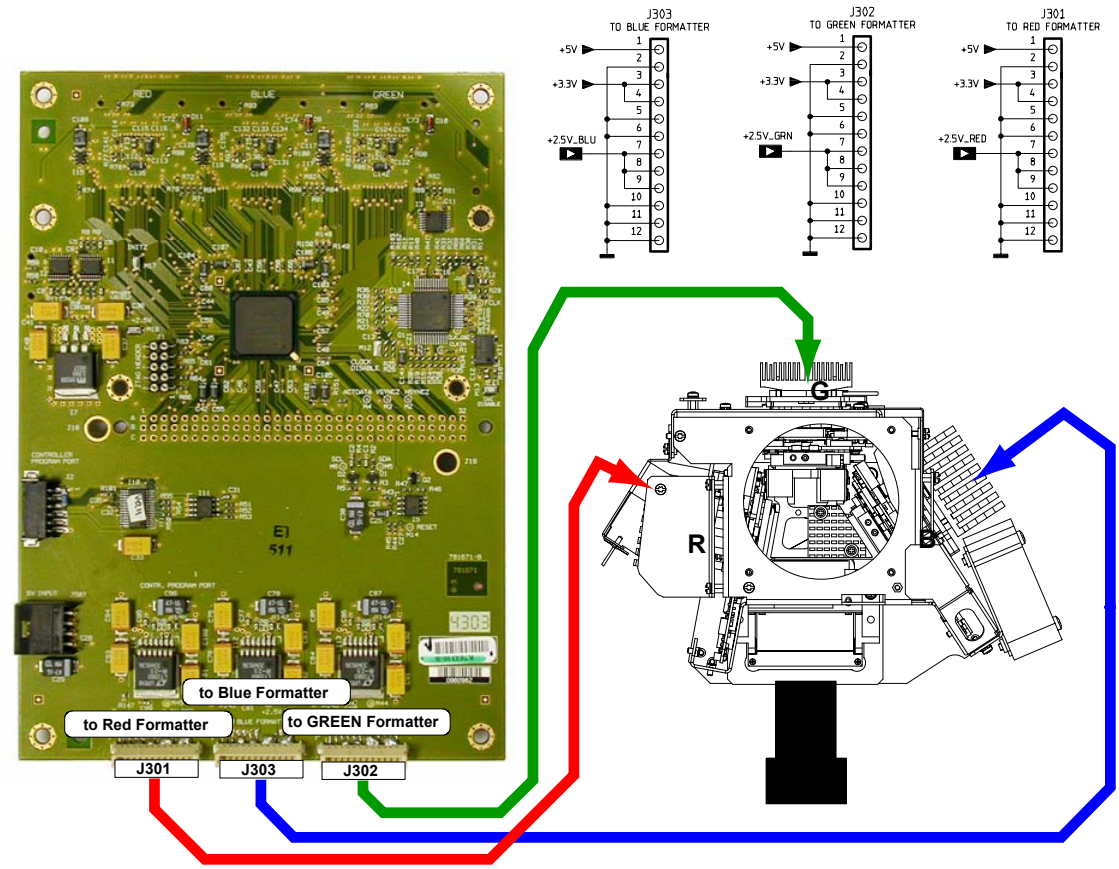
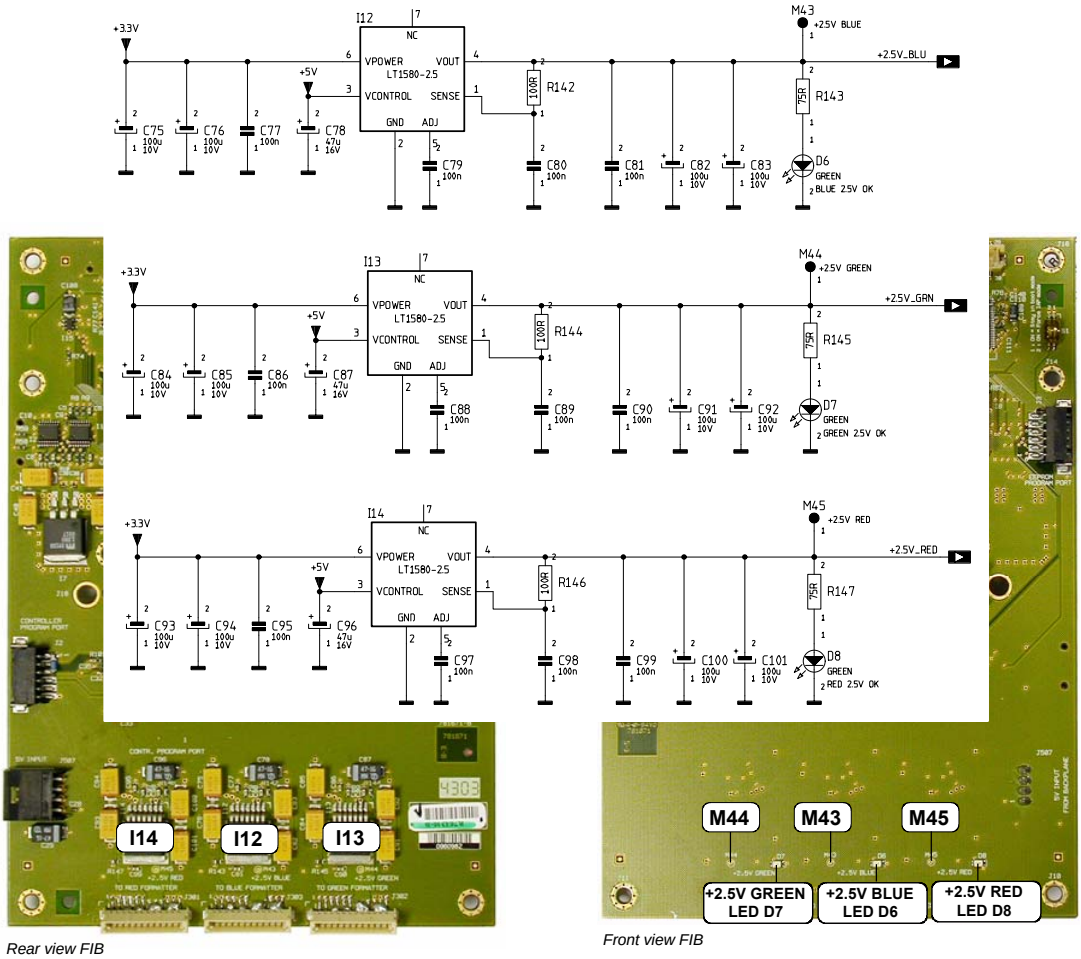


Image 19-4
Power Supply to DMD Formatters

Power Voltage generated on Board

On board, 3 LT®1580 7A low dropout regulators are provided to generate the +2.5V for the 3 DMD formatters. The dropout voltage of this device is 100mV at light loads rising to just 540mV at 7A. To achieve this dropout, a second low current input voltage 1V greater than the output voltage, is required. The device can also be used as a single supply device where dropout is comparable to an LT1584. A remote SENSE pin is brought out. This feature virtually eliminates output voltage variations due to load changes. Typical load regulation, measured at the SENSE pin, for a load current step of 100mA to 7A is less than 1mV. The LT1580 has fast transient response, equal to the LT1584. On fixed voltage devices, the ADJ pin is brought out. A small capacitor on the ADJ pin further improves transient response.



Rear view FIB

Front view FIB

Image 19-5
Power Voltage generated on Board

Signals to DMD Formatters

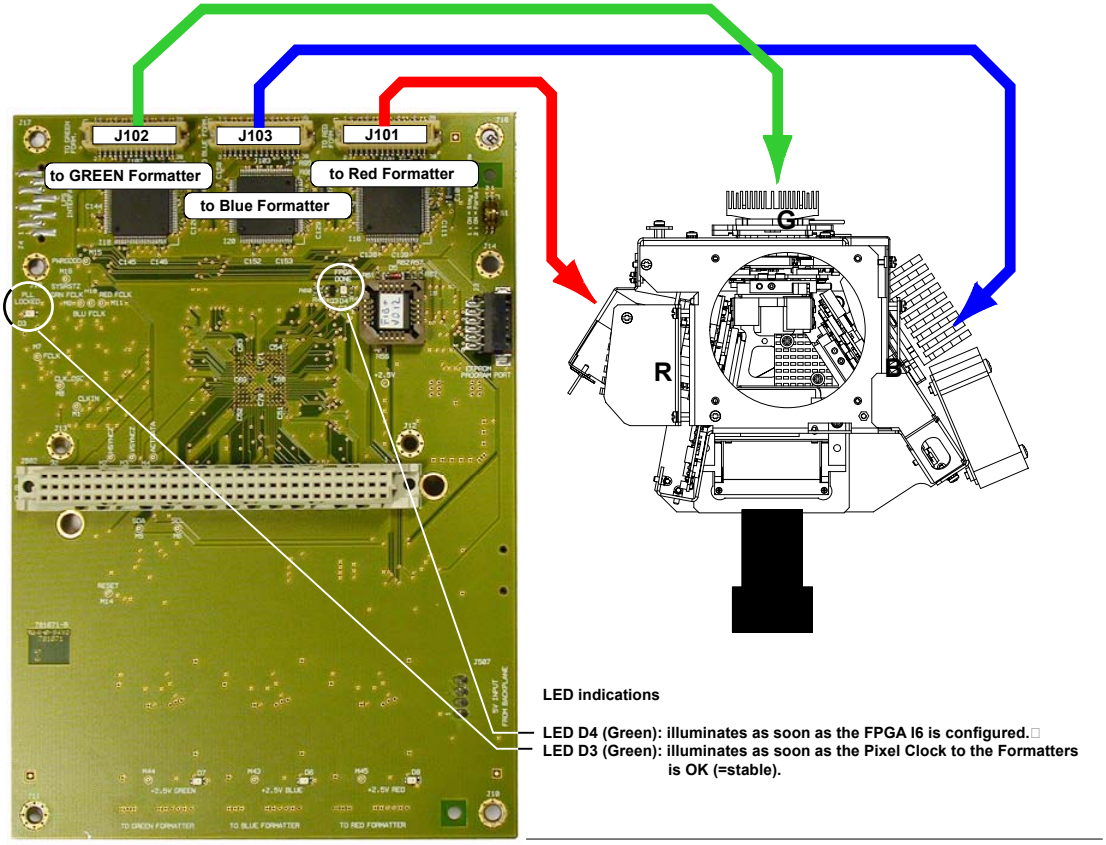


Image 19-6
Signals to DMD Formatters

20. CPU MODULE R7638858

20.1 Introduction

View of the module

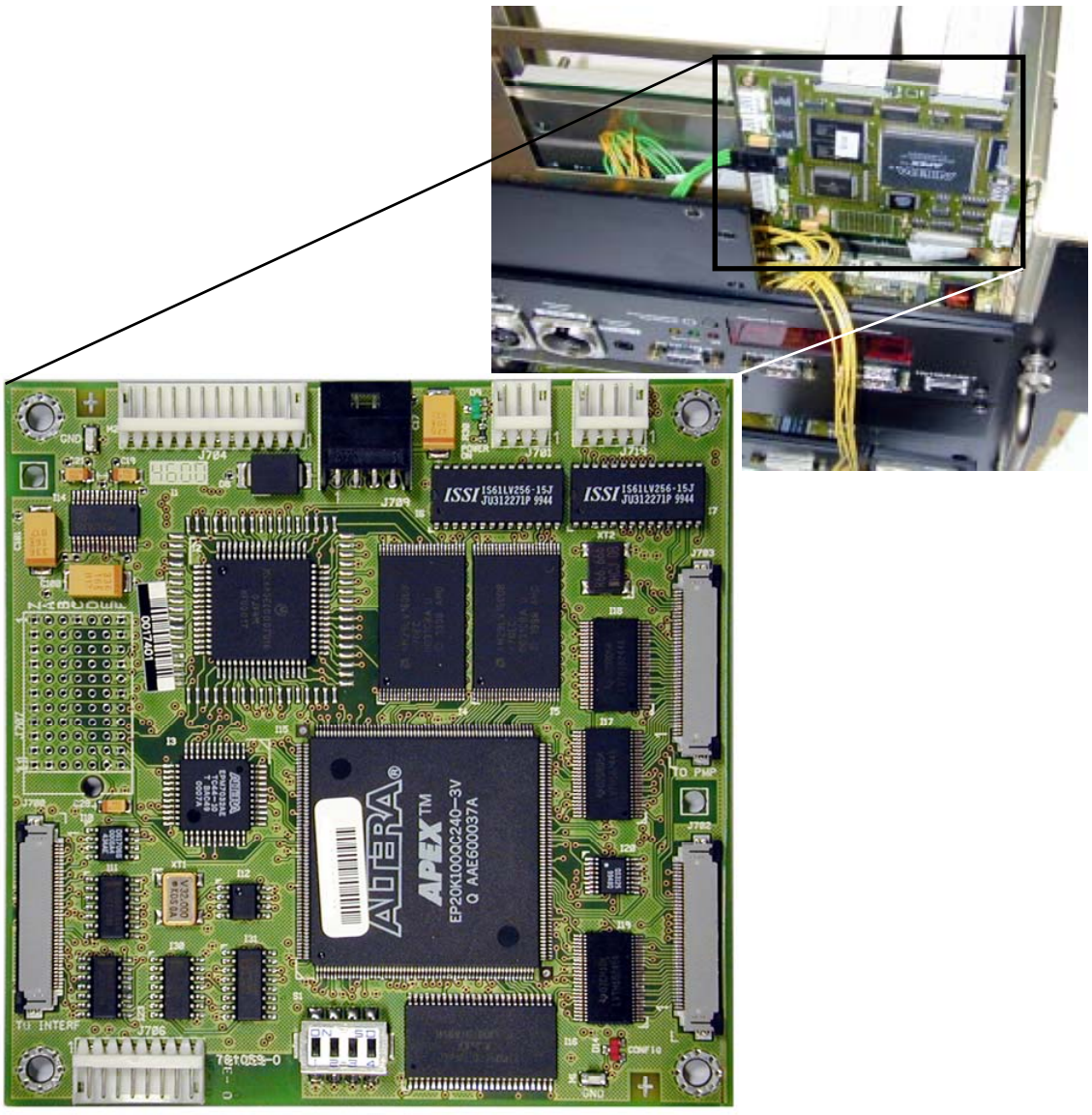


Image 20-1
View of the module

20.2 Block Diagram CPU

Block Diagram

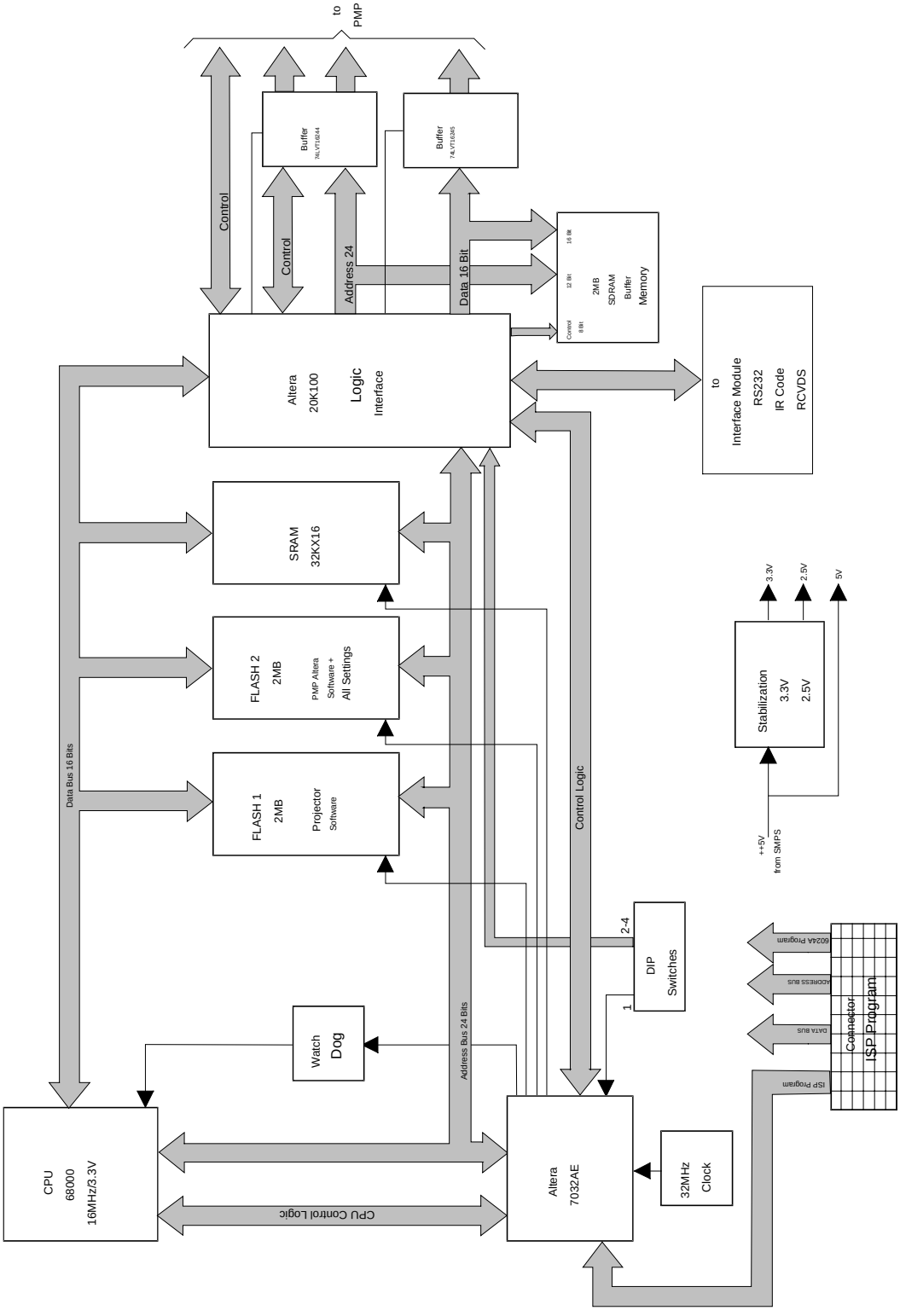


Image 20-2

20.3 Power Supply on Board

Power Supply

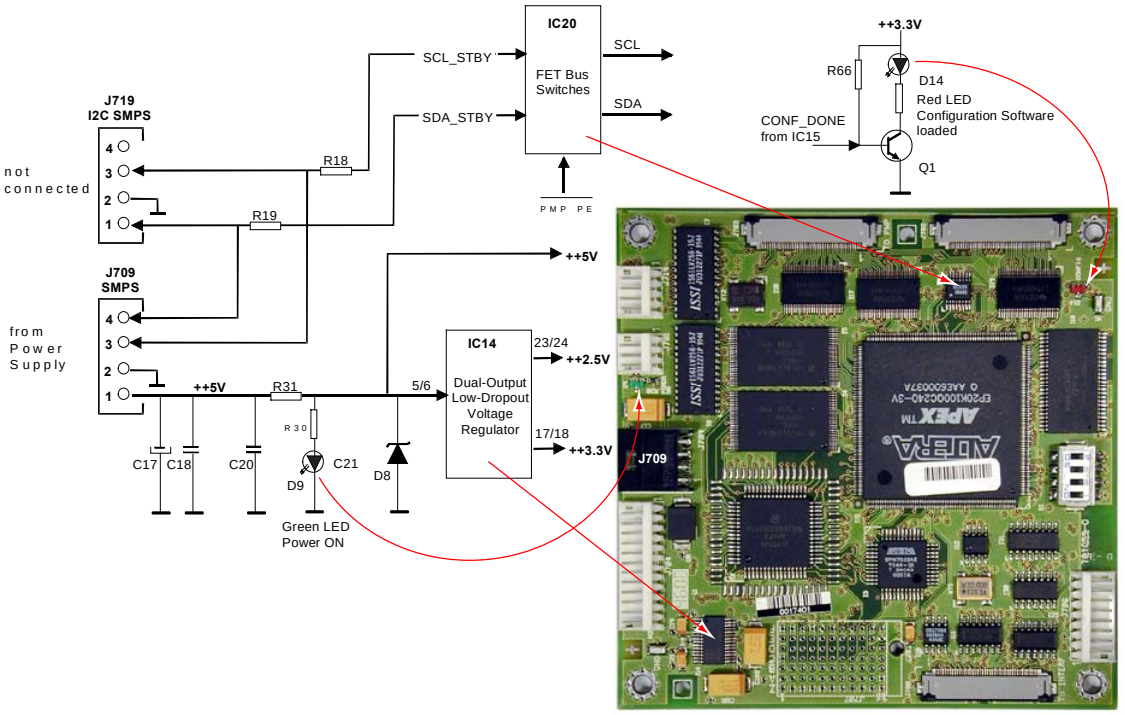


Image 20-3
Power Supply on Board

20.4 Functions on Board

Explanation functions on board

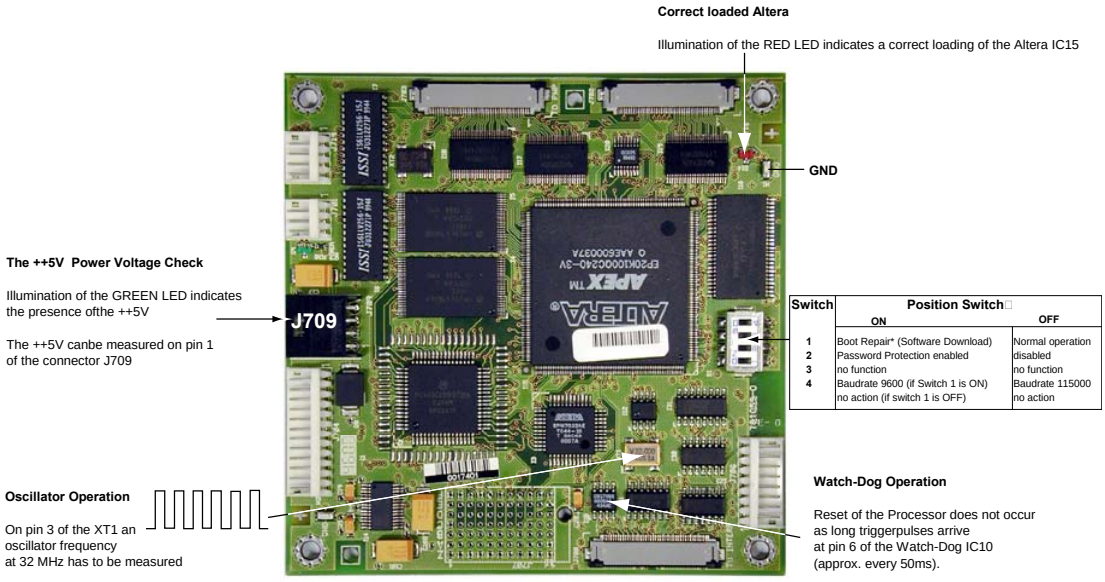

Correct loaded Altera
Illumination of the RED LED indicates a correct loading of the Altera IC15
GND
The ++5V Power Voltage Check
Illumination of the GREEN LED indicates the presence ofthe ++5V
The ++5V canbe measured on pin 1 of the connector J709
J709
Switch
Position Switch
ON
OFF
1 Boot Repair* (Software Download) Normal operation
2 Password Protection enabled disabled
3 no function no function
4 Baudrate 9600 (if Switch 1 is ON) Baudrate 115000
no action (if switch 1 is OFF) no action
Oscillator Operation
On pin 3 of the XT1 an oscillator frequency at 32 MHz has to be measured
Watch-Dog Operation
Reset of the Processor does not occur as long triggerpulses arrive at pin 6 of the Watch-Dog IC10 (approx. every 50ms).

Image 20-4
Functions on Board

20.5 Interconnection Diagram

Diagram

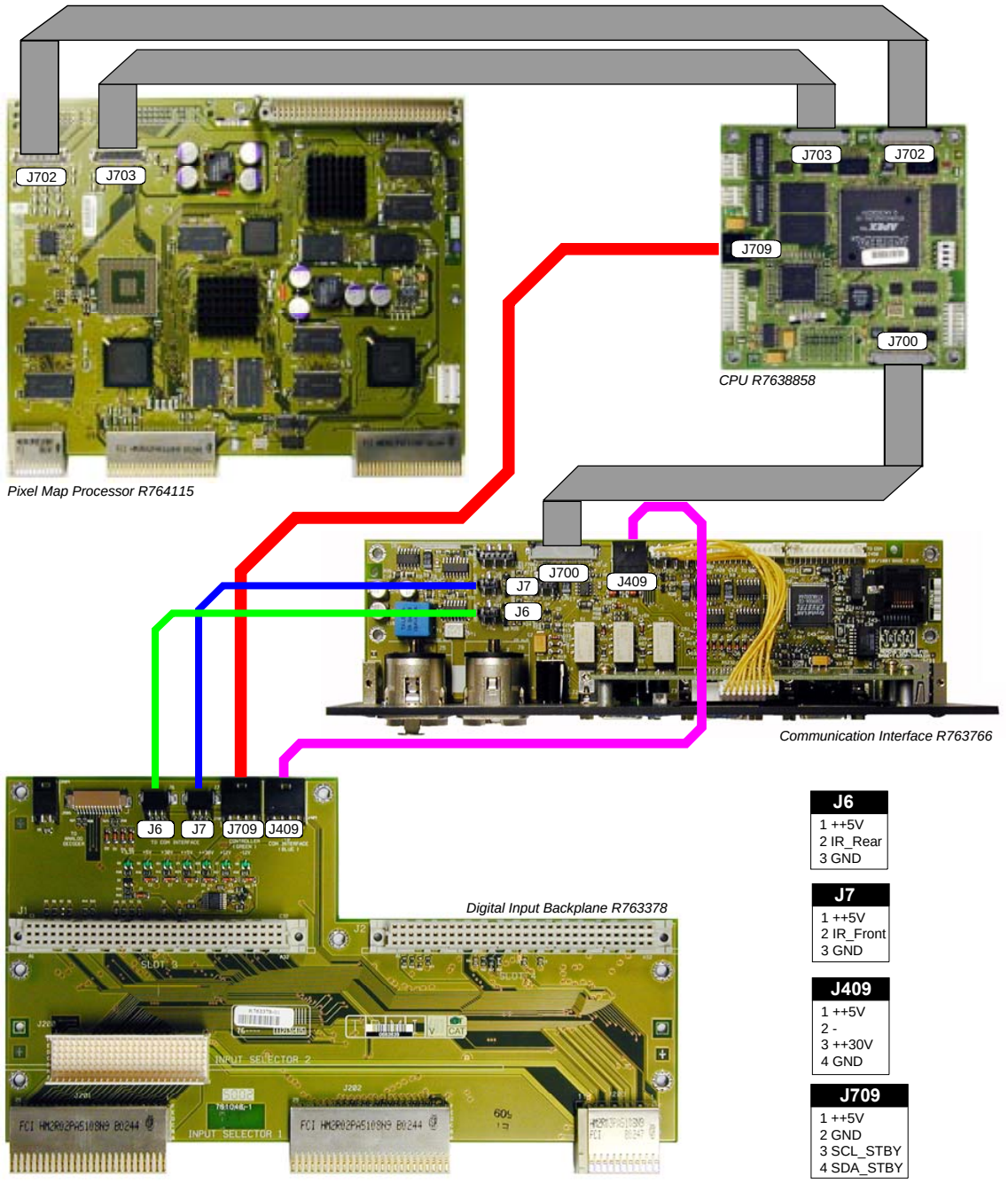


Image 20-5
Interconnection Diagram

21. PIXEL MAP PROCESSOR MODULE R764115

21.1 View of the PMP Module

Location of the PMP

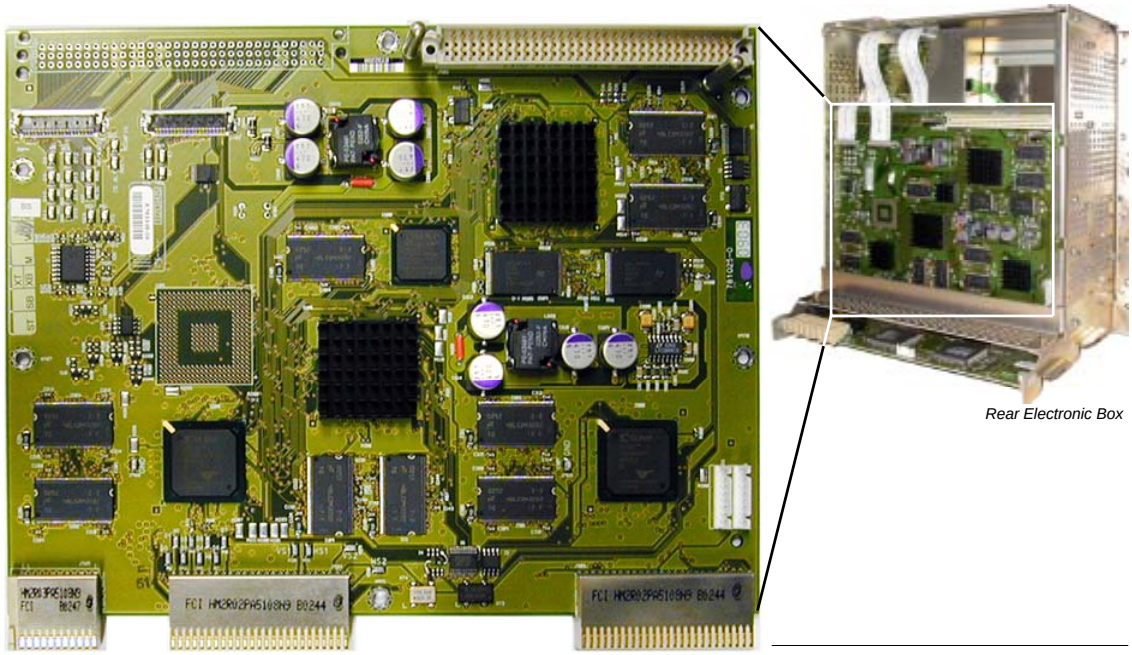


Image 21-1
Location of the PMP Module

21.2 Block Diagram PMP

Block diagram

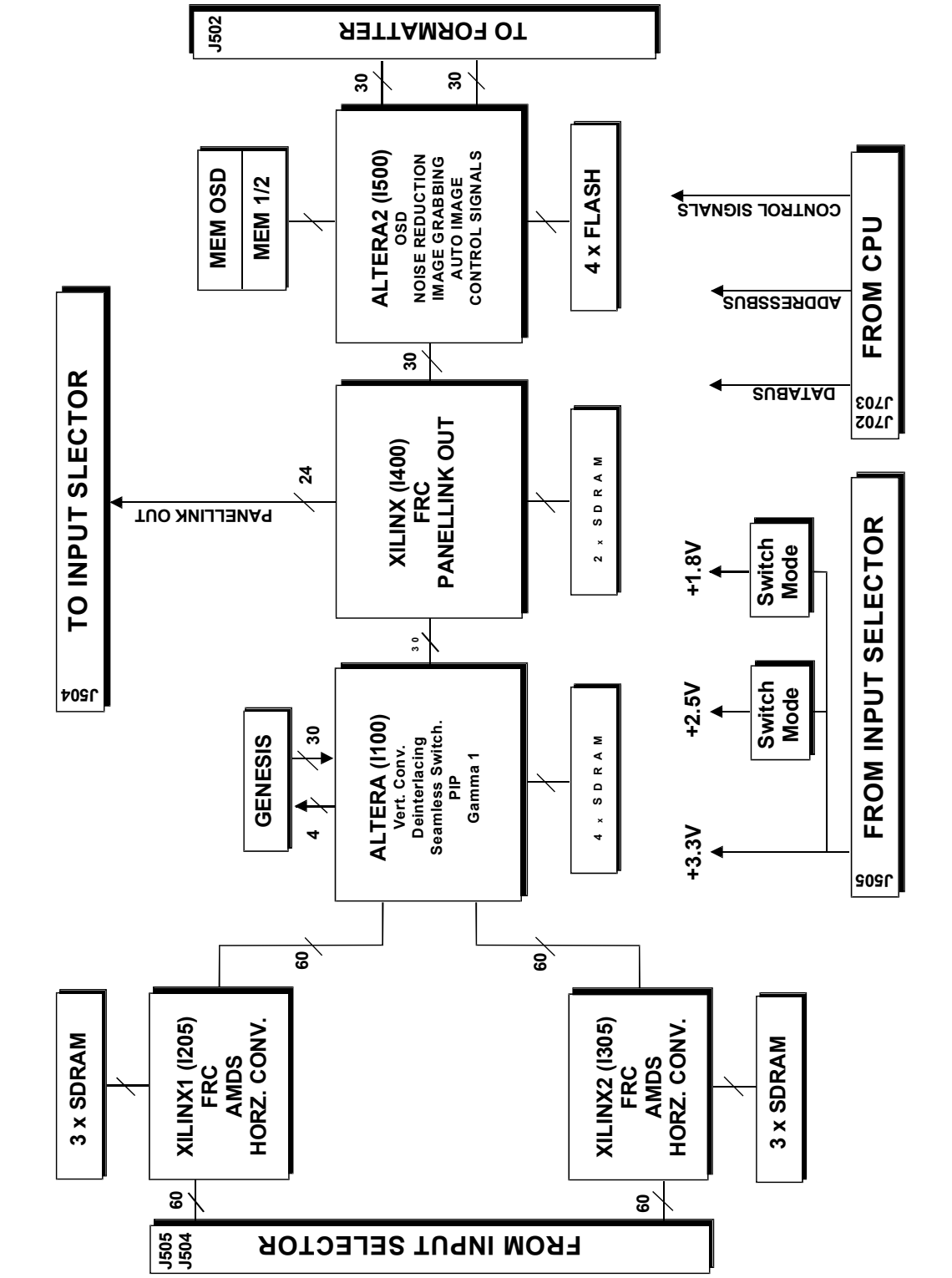


Image 21-2
Block diagram PMP

21.3 Short Technical Description

Data Path

Digital RGB data coming form input selector 1 enters the PMP where the data is stored in an SDRAM frame memory. Therefore an SDRAM controller is needed and this controller is implemented in a Xilinx programmable component. Also, the horizontal conversion to the native resolution is done in this component.

Data is vertically converted to the native resolution in an Altera that also contains the deinterlacer.

Then the data is processed for video enhancements in a second Altera. Also the On Screen Display is inserted in this second Altera.

After conversion and video processing, the data is sent to the formatter board.

Controlling the board

In order to do the pixel mapping properly, there is need of some control functions. Some important functions are:

AMDS

The Automatic Mode Detection and Synchronization circuit detects the source applied to the projector.

OSD

A character flash and a SDRAM device are connected to the controller. The flash contains the shapes of each possible character, while the SDRAM contains the codes of the characters that needs to be shown on the screen. The controller sends the result to Altera's for insertion.

Processor Interface

A processor interface is implemented in order to be able to communicate with the main processor board. The main processor sends its data through the processor interface to the different components on the board or to internal control registers.

Clock Circuit

The main clock circuit consists of crystal oscillators and some clock buffers and multipliers.

Power Supply

3.3V is supplied directly to the board, which eliminates a 3.3V power supply. Two switch modes convert the 3.3V in to 1.8V and 2.5V.

Software Adjustments

- Geometry parameters: All geometry settings are done on the Pixel Map Processor:
- Noise reduction: Signals are motion adaptive temporarily filtered dependent on a non-linear transform of their spectral energy distribution.

21.4 Power Supply

Introduction

The PMP module receives the +3.3V power voltage from the SM Power supply. For the low voltage logic on board, two low power voltages, a +1.8V and a 2.5V, are generated using each a step-down switching regulator controller (see schematics: sheet 9).

The +2.5V is applied to the Xilinx I400 whereas the +1.8V is applied to the Altera's I500, I100 and the Xilinx's I205, I305.

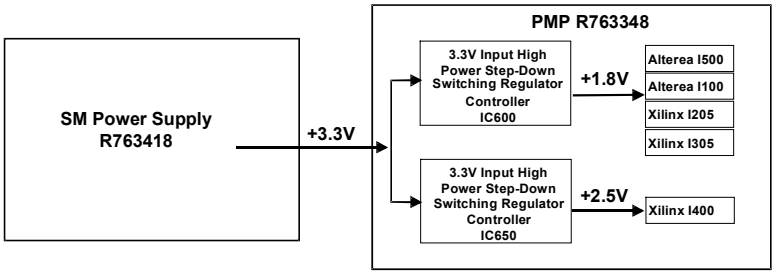


Image 21-3
Power Supply

Diagram Power Supply

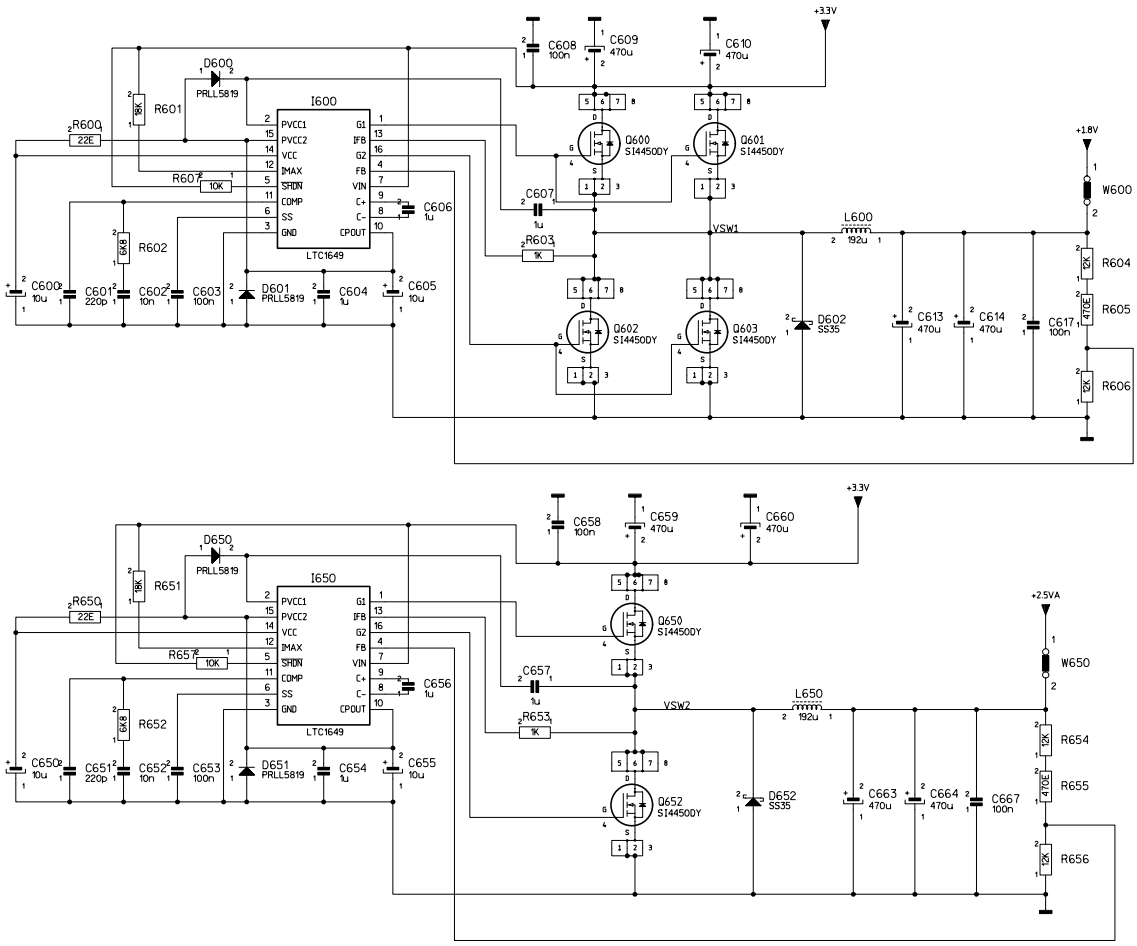


Image 21-4
Diagram Power Supply

Component location on board

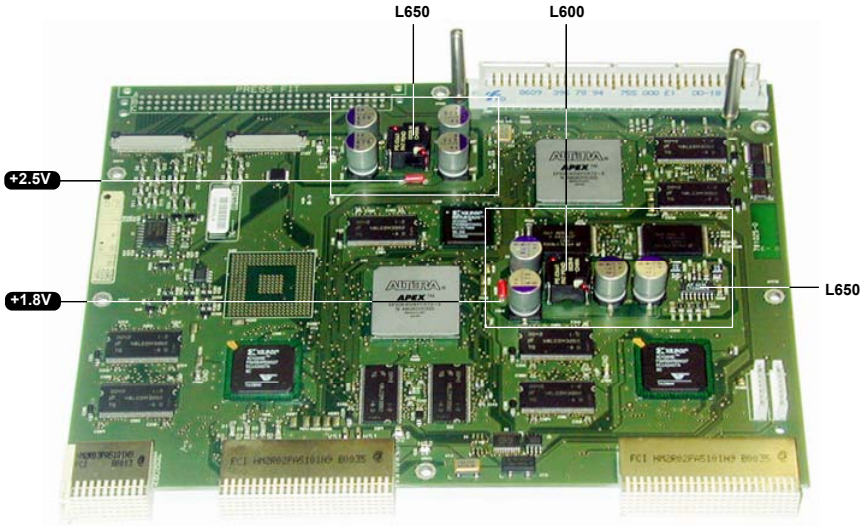


Image 21-5
Component location on board/1

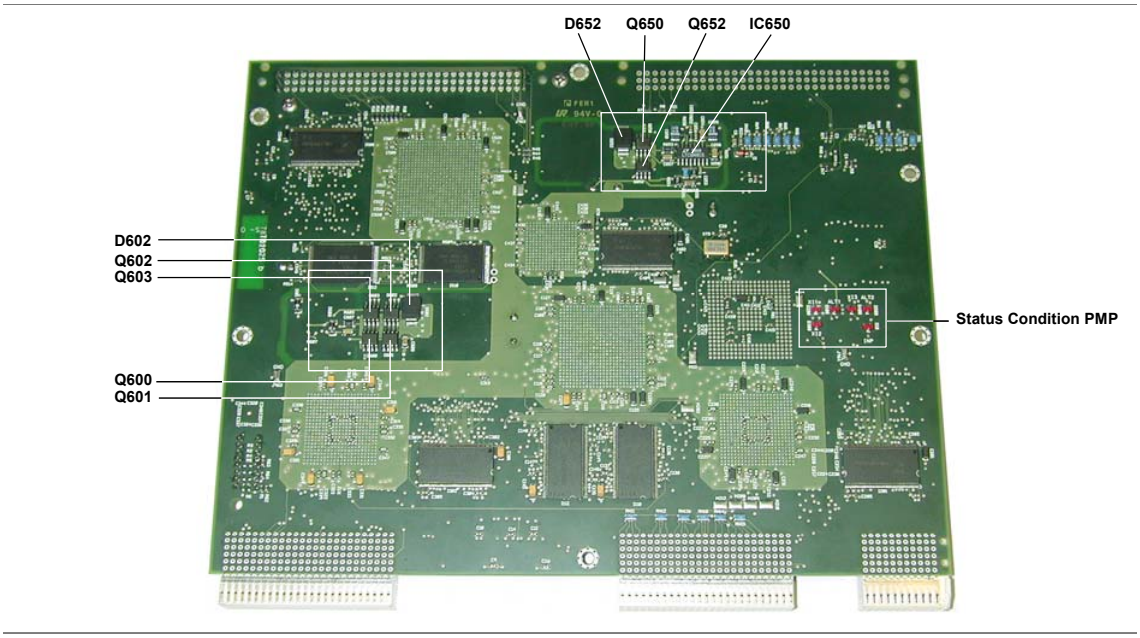


Image 21-6
Component location on board/2

21.5 Status Conditions / Fault Analysis

Introduction

The load condition of the programmable logic's is indicated by means of a Red LED, linked to the respective logic IC. Non lightning of a LED indicates correct loaded IC. These LED's, mounted on the rear of the PMP module, become visible when the dummy plate, covering the second SDI Input, or the mounted second SDI module itself is removed.

Location of the LEDs

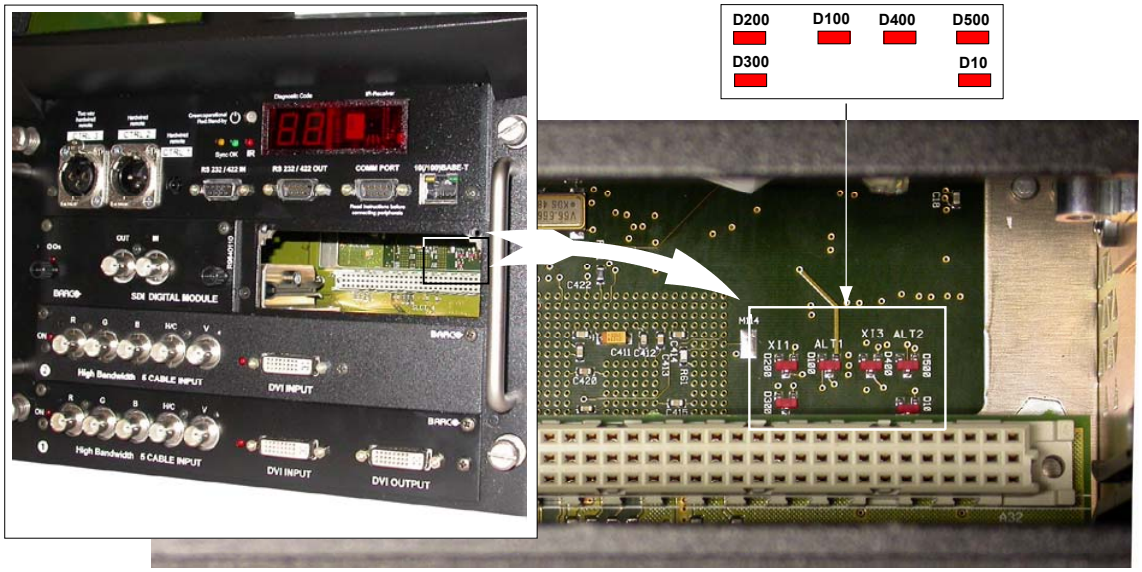


Image 21-7
Location of the LEDs

LED Ref.	IC Ref.	Descriprion
D10	Logics on Input Selector	LED On: logics on input selector configured
D100	Altera IC100	LED On: Altera configured
D200	Xilinx IC205	LED On: Xilinx configured

LED Ref.	IC Ref.	Descriprion
D300	Xilinx IC305	LED On: Xilinx configured
D400	XilinxIC400	LED On: Xilinx configured
D500	Altera IC500	LED On: Altera configured

22. INFRA RED RECEIVER MODULE R763261

22.1 View of the Infra Red Receiver

Location of the module

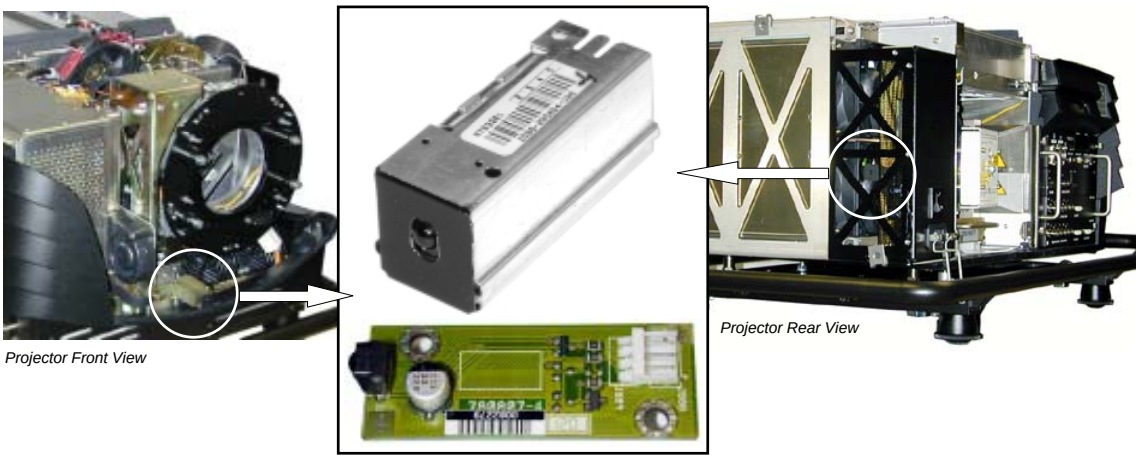


Image 22-1
Location of the IR Receiver module

22.2 Block Diagram IR Receiver

Block Diagram

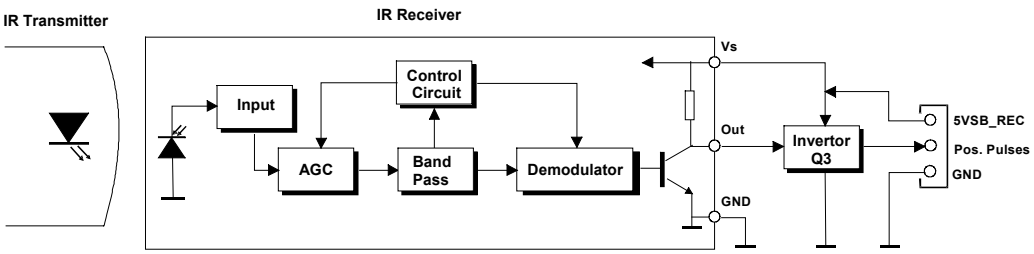


Image 22-2
Block diagram IR Receiver

Technical Info

The TSOP1836 (Carrier frequency at 36 kHz) is an miniaturized receivers for infrared remote control systems. PIN diode and pre-amplifier are assembled on lead frame, the epoxy package is designed as IR filter. The demodulated output signal can directly be decoded by a microprocessor. The main benefit is the reliable function even in disturbed ambient and the protection against uncontrolled output pulses.

Features TSOP1386

- Photo detector and preamplifier
- Internal filter for PCM frequency
- TTL and CMOS compatibility
- Output active low
- Improved shielding against electrical field disturbance
- Enhanced immunity against all kinds of disturbance light
- No occurrence of disturbance pulses at the output
- Short settling time after power on (<200µs)

22.3 Interconnection Diagram

IR module connection to Power Backplane

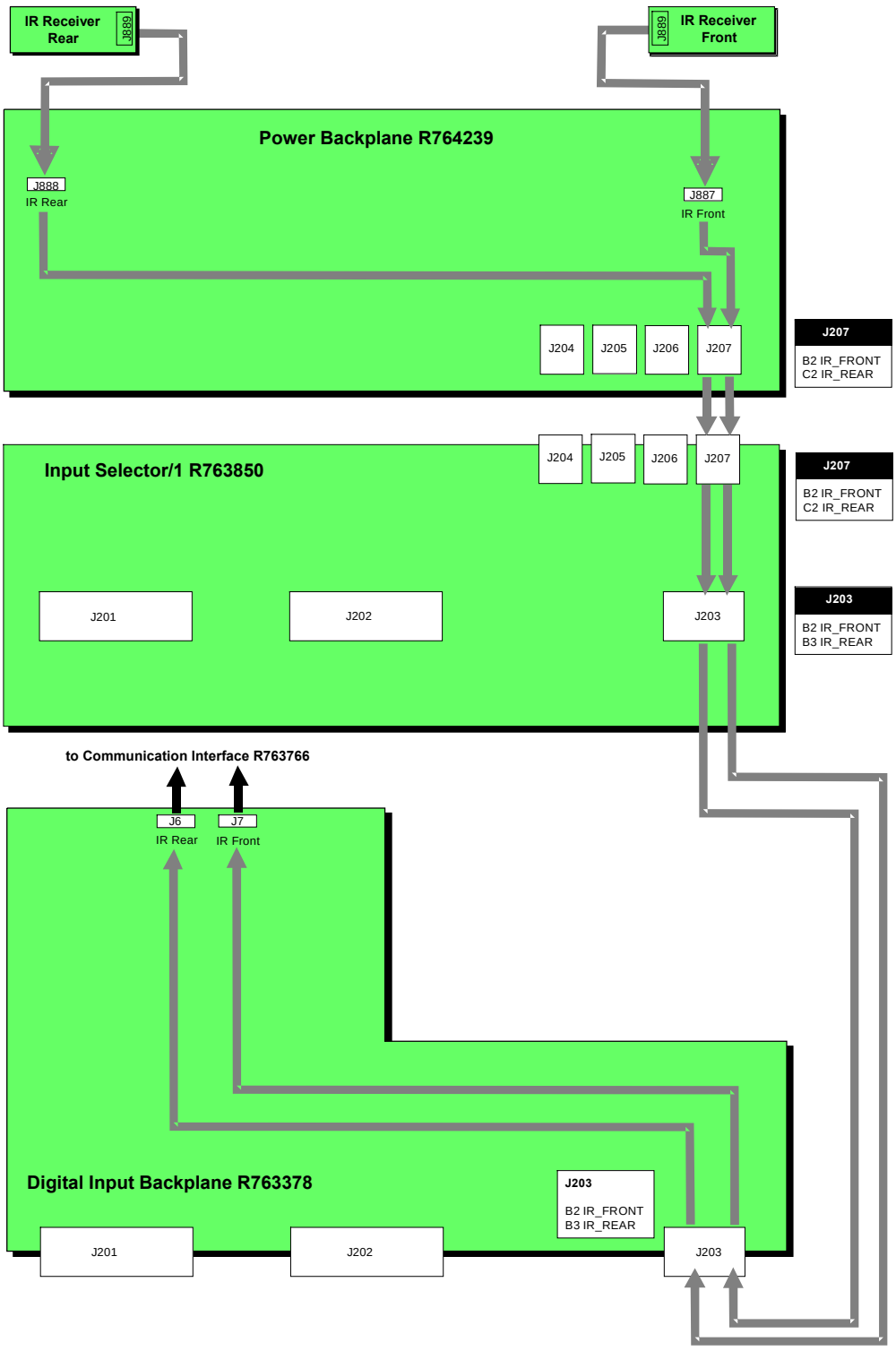


Image 22-3
IR module connection to Power Backplane

IR signal flow to CPU

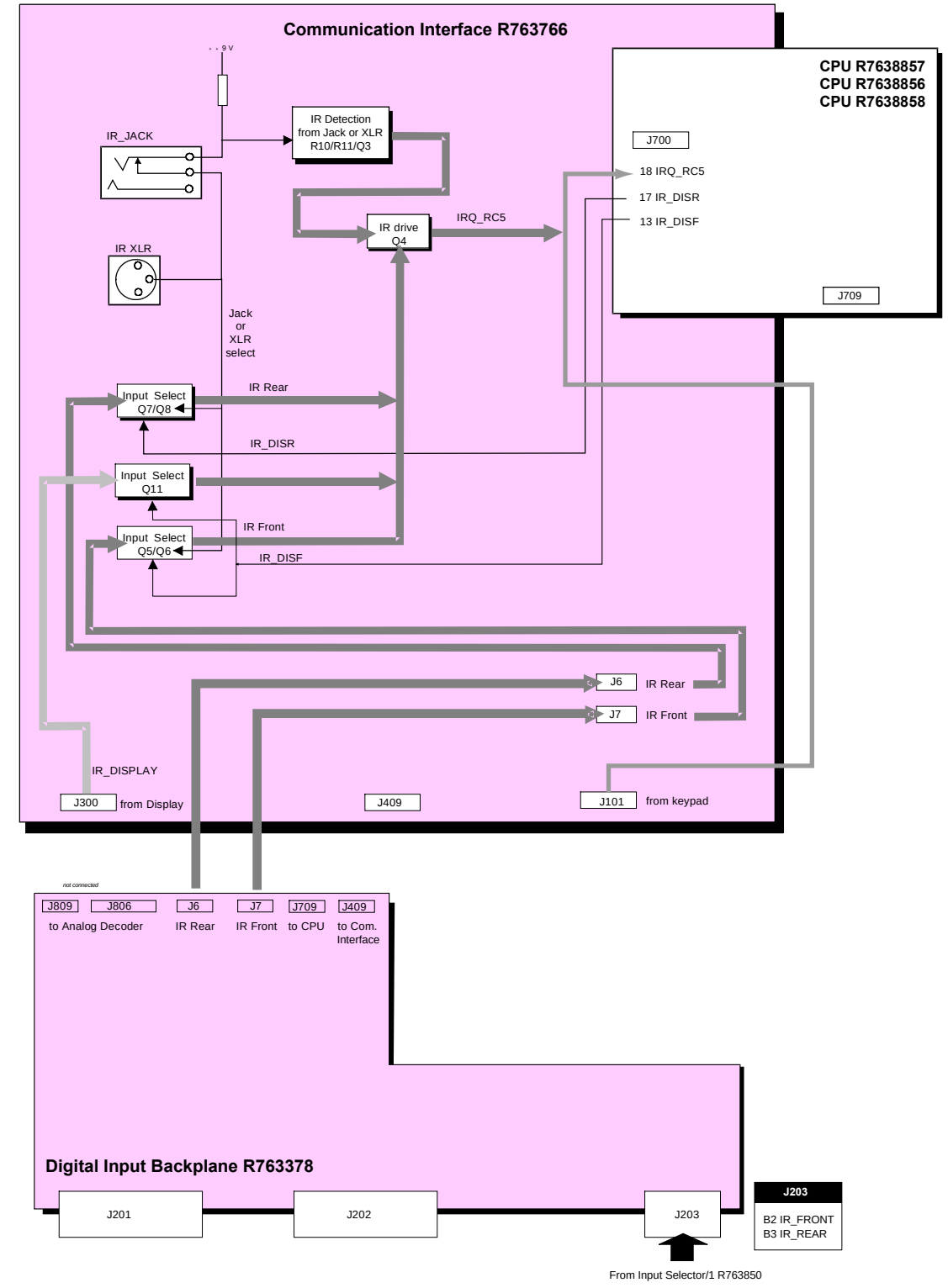


Image 22-4
IR signal flow to CPU

23. AMBIENT TEMPERATURE SENSOR R762790

23.1 View of the Ambient Temperature Sensor

Location of the module

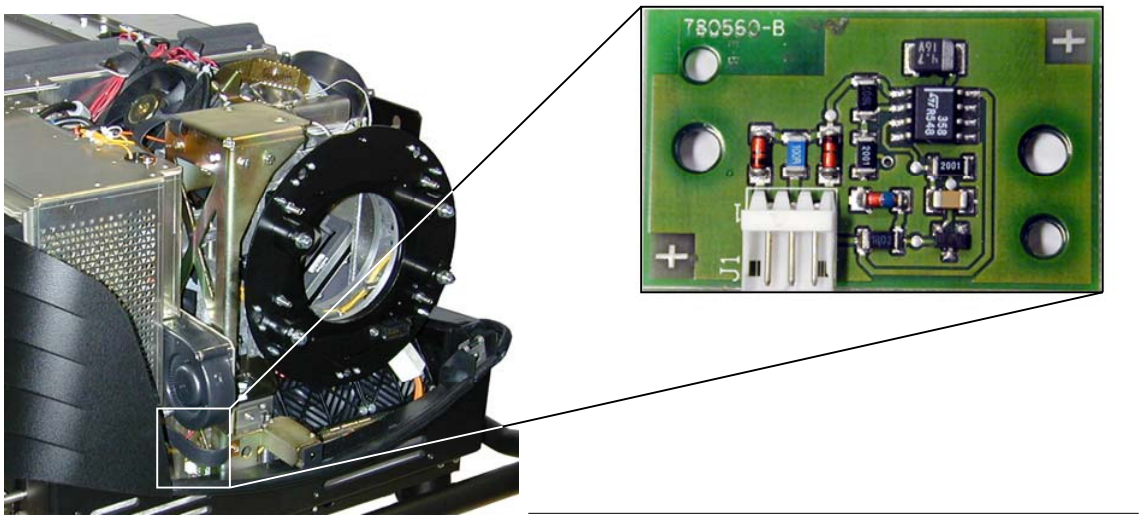


Image 23-1
Location of the module

23.2 Interconnection Diagram

Interconnection with SMPS

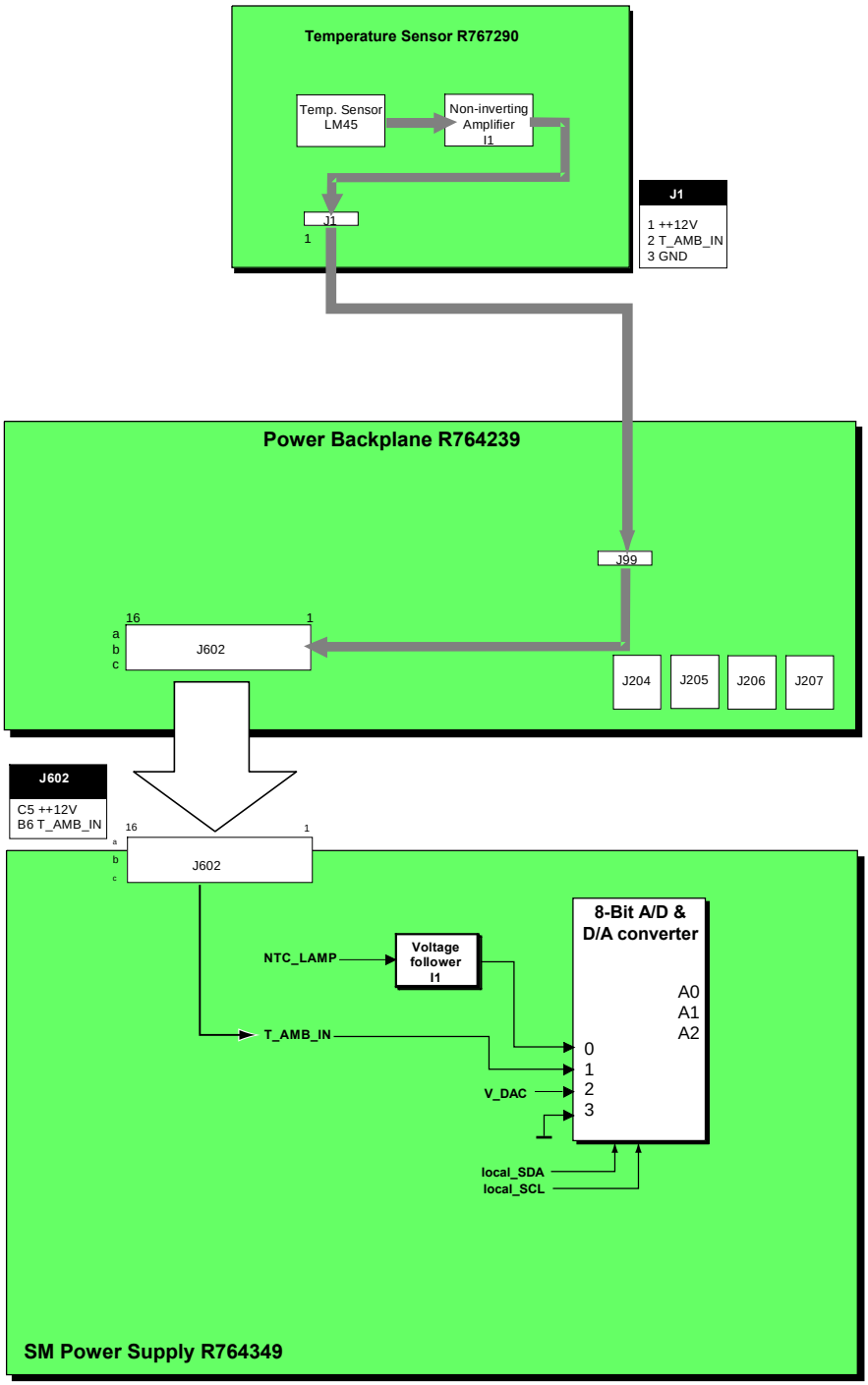
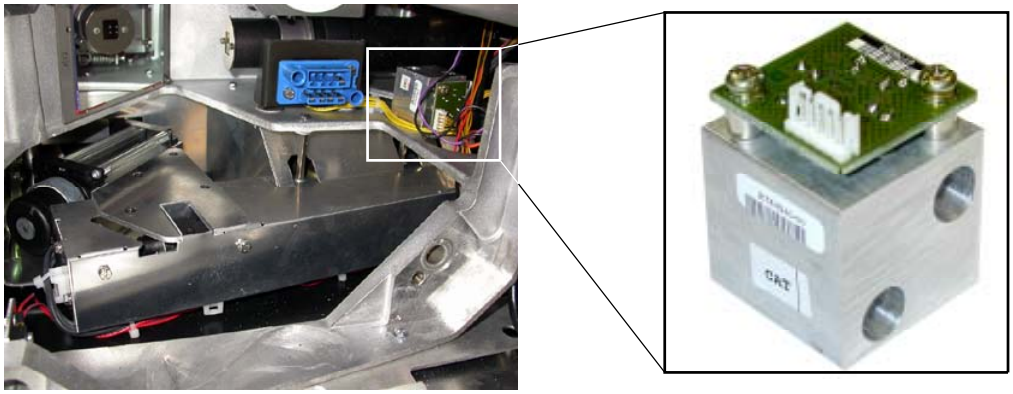


Image 23-2
Interconnection with SMPS

24. PROJECTOR TILT SWITCH R764240

24.1 View of the projector Tilt Switch

Location of the module



View inside lamp house

Image 24-1
Location of the tilt switch module

24.2 Projector Tilting Protection

Explanatory Drawing

In a projector mounting configuration where tilting of the projector is required, pay attention to the followings mountings rules to maintain maximum performances of the Xenon lamp:

- Tilting the projector according the projection axis has no restrictions.
- Tilting the projector according the lamp axis is limited. As a rule of thumb, the cathode of the Xenon lamp in the mounting configuration may not be positioned 15° (maximum) higher than the anode.

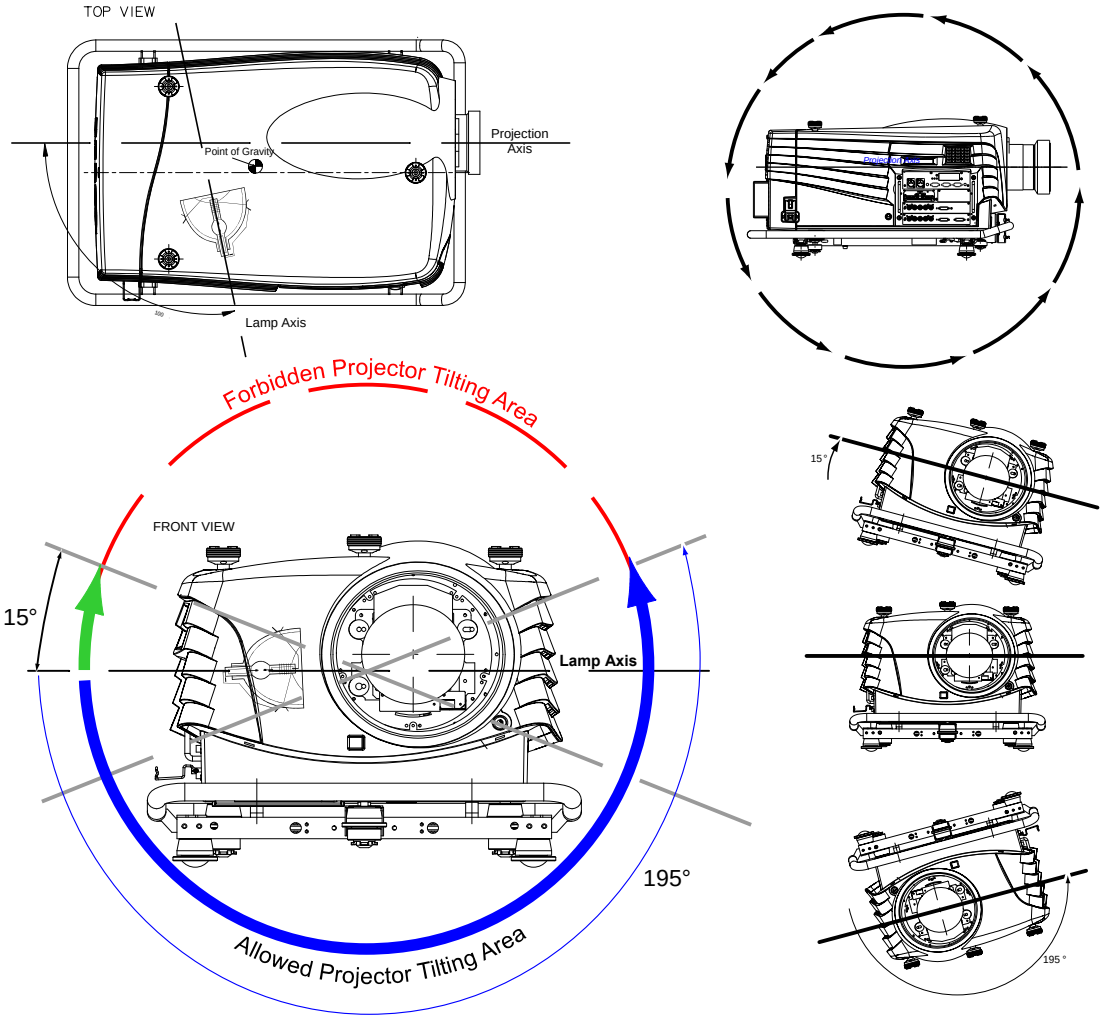


Image 24-2
Projector tilting range

24.3 Interconnection Diagram

Interconnection with SMPS

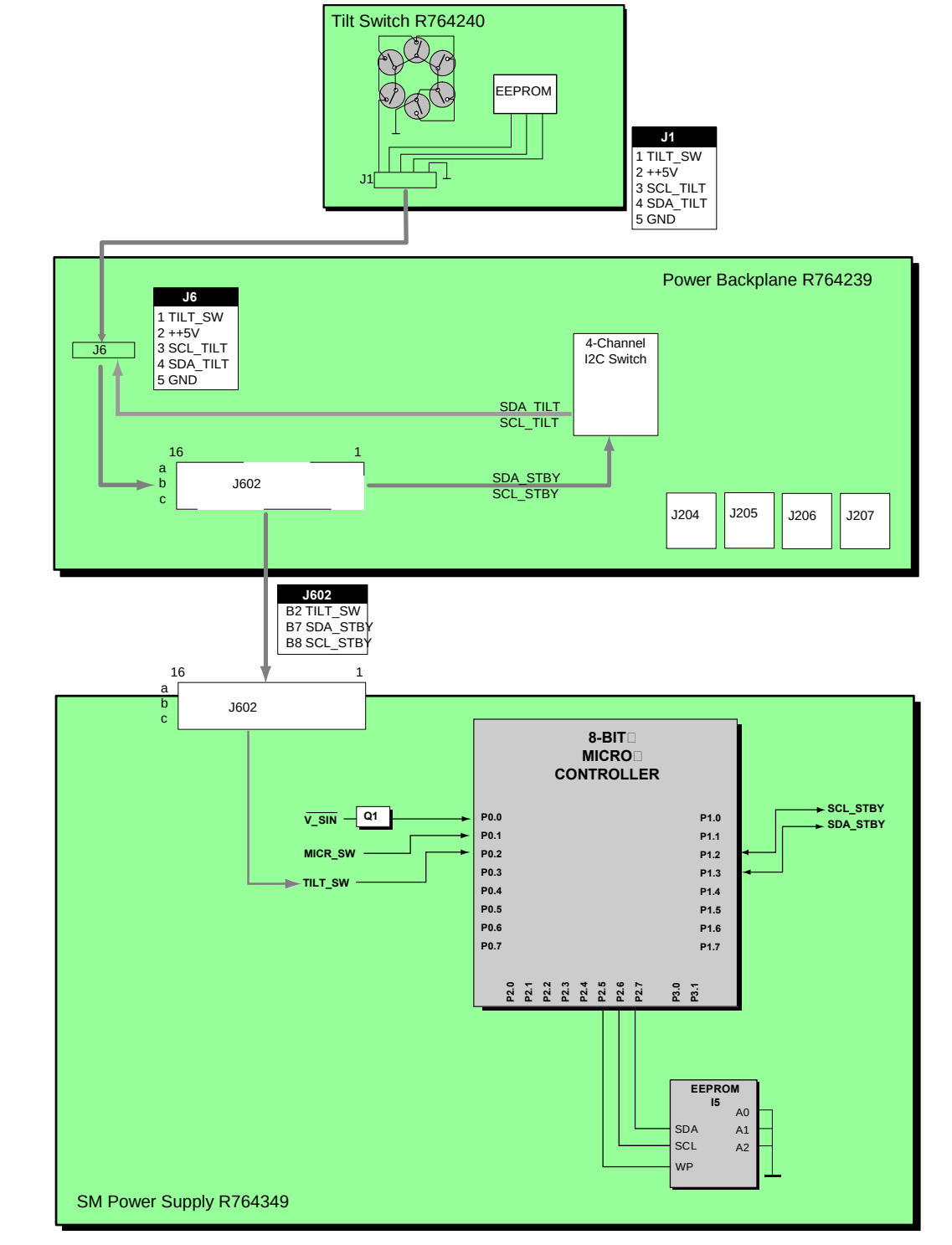


Image 24-3
Interconnection with SMPS

25. LIGHT OUTPUT SENSOR R763294

25.1 View of the Light Output Sensor

Location of the module

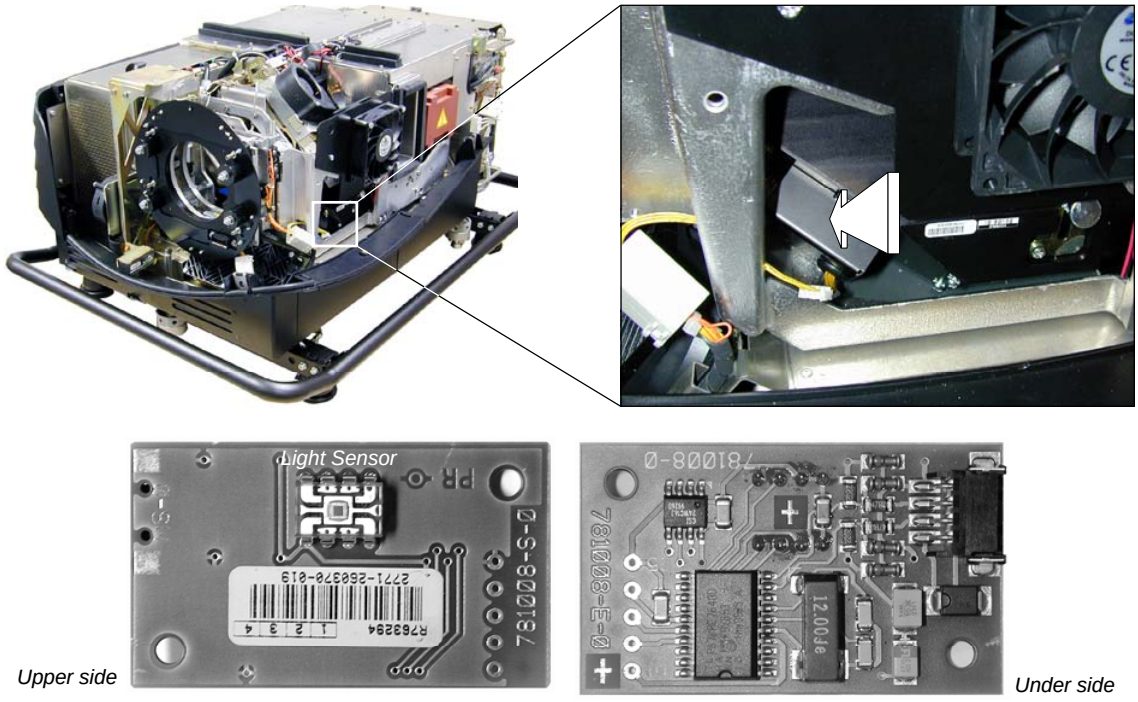


Image 25-1
Location of the module

25.2 Technical Info

Block diagram Light Sensor

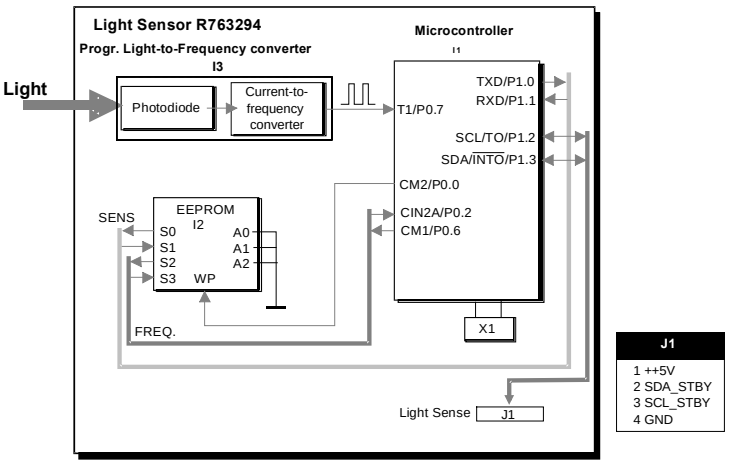


Image 25-2
Block diagram Light Sensor

Short description

The intensity of light is measured with the help of sensor I3, which is a programmable Light-to-Frequency converter.

The output frequency of the light-to-frequency converter is directly proportional to the intensity of light falling on the sensor.

The microcontroller IC I1 execute a frequency measurement and will spread it out over a longer period.

On the basis of reference measurement, stored in de EEPROM IC2, the number of corresponding centrum-lumens are calculated.

25.3 Interconnection with CPU

Interconnection diagram

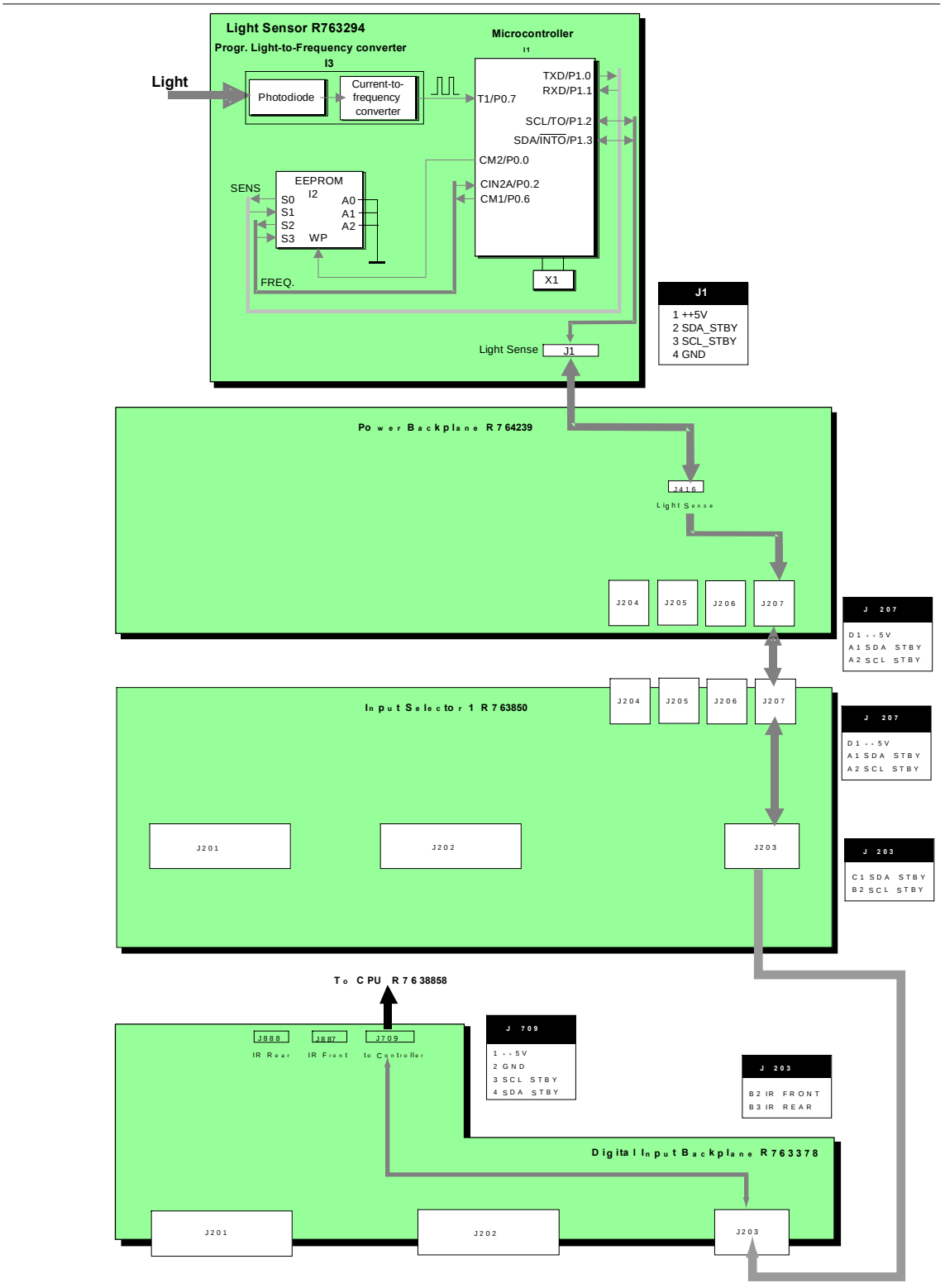
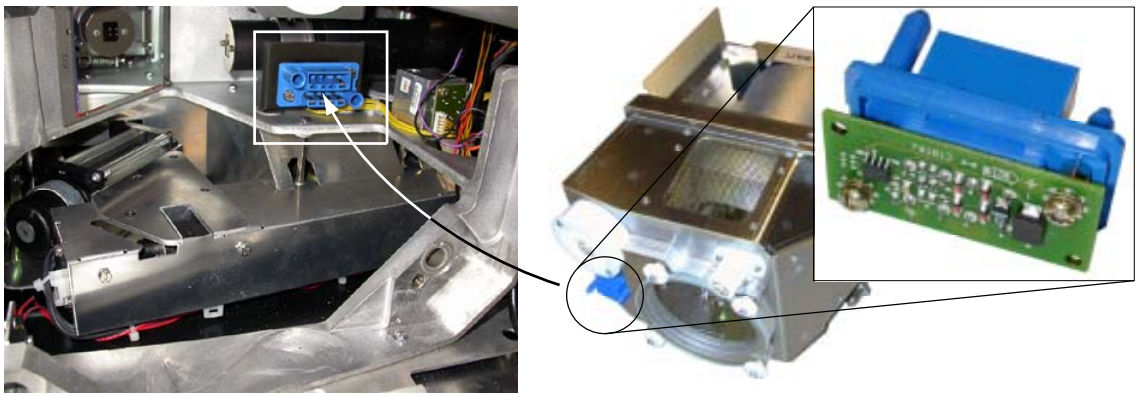


Image 25-3
Interconnection diagram with CPU

26. LAMP INFO MODULE R763295

26.1 View of the Lamp Info

Location of the module



View inside lamp house

Image 26-1
Location of the module

26.2 Interconnection Diagram

Diagram

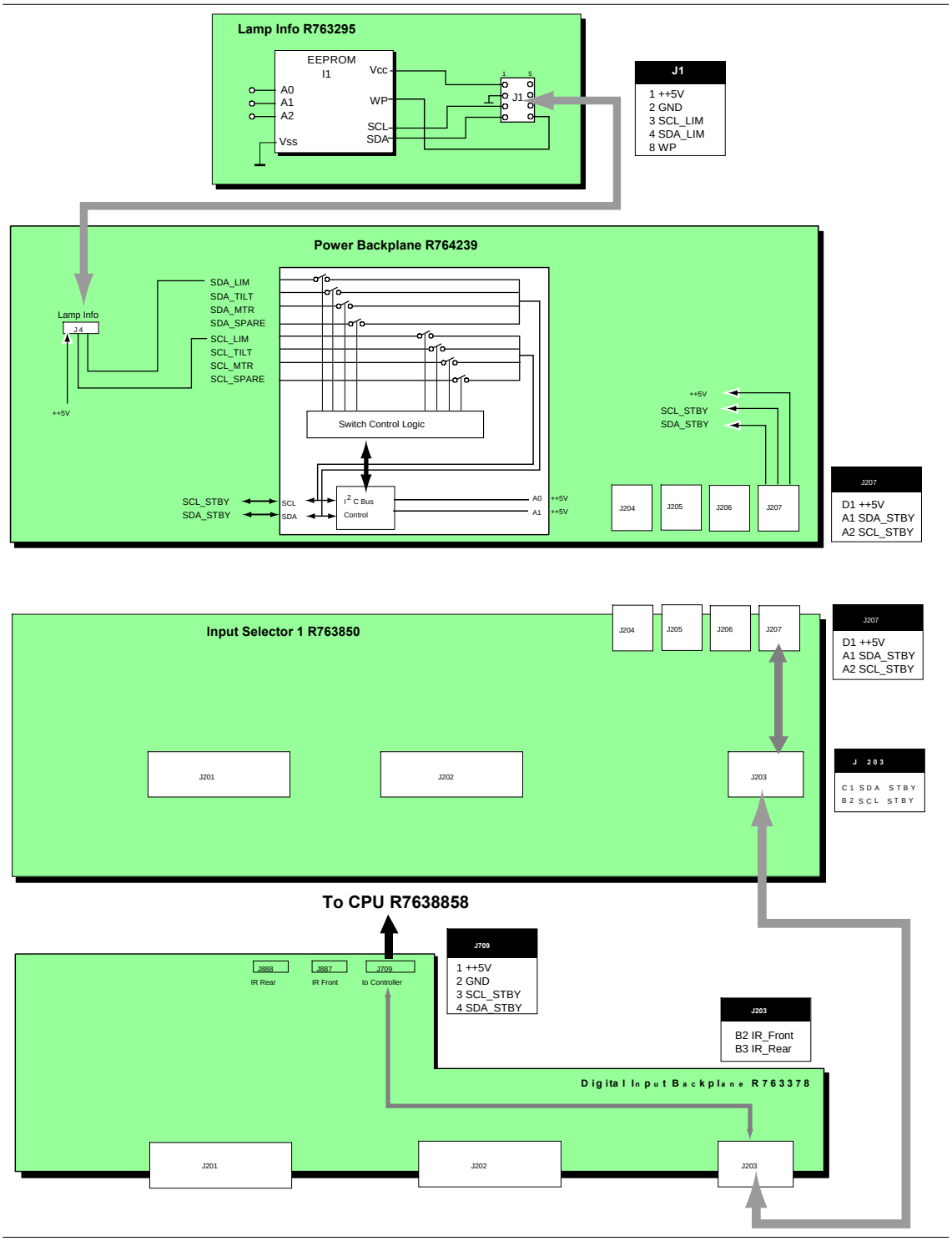


Image 26-2
Interconnection Diagram

26.3 Technical Info

Description EEPROM X24C16A

The EEPROM provides 16384 bits of serial electrically erasable and programmable read-only memory (EEPROM) organized as 2048 words of 8 bits each.

Pin Configurations

Pin	Pin Name	Function	Pin Description
1-3	A0 - A2	Address Inputs	The X24C16A does not use the device address pins. The A0, A1 and A2 pins are no-connects.
4	GND	Ground	
5	SDA	Serial Data	The SDA pin is bidirectional for serial data transfer. This pin is open-drain driven and may be wired-ORed with any number of other open-drain or open collector devices.
6	SCL	Serial Clock Input	The SCL input is used to positive edge clock data into each EEPROM device and negative edge clock data out of each device.
7	WP	Write protect	The X24C16A has a WP pin that provides hardware data protection. The WP pin allows normal read/write operations when connected to ground (GND). When the WP pin is connected to Vcc, the write protection feature is enabled.
8	Vcc	Power voltage	++5V

27. MAINTENANCE

27.1 Lens Block

27.1.1 Overview of Micro Switches and Motors

Overview

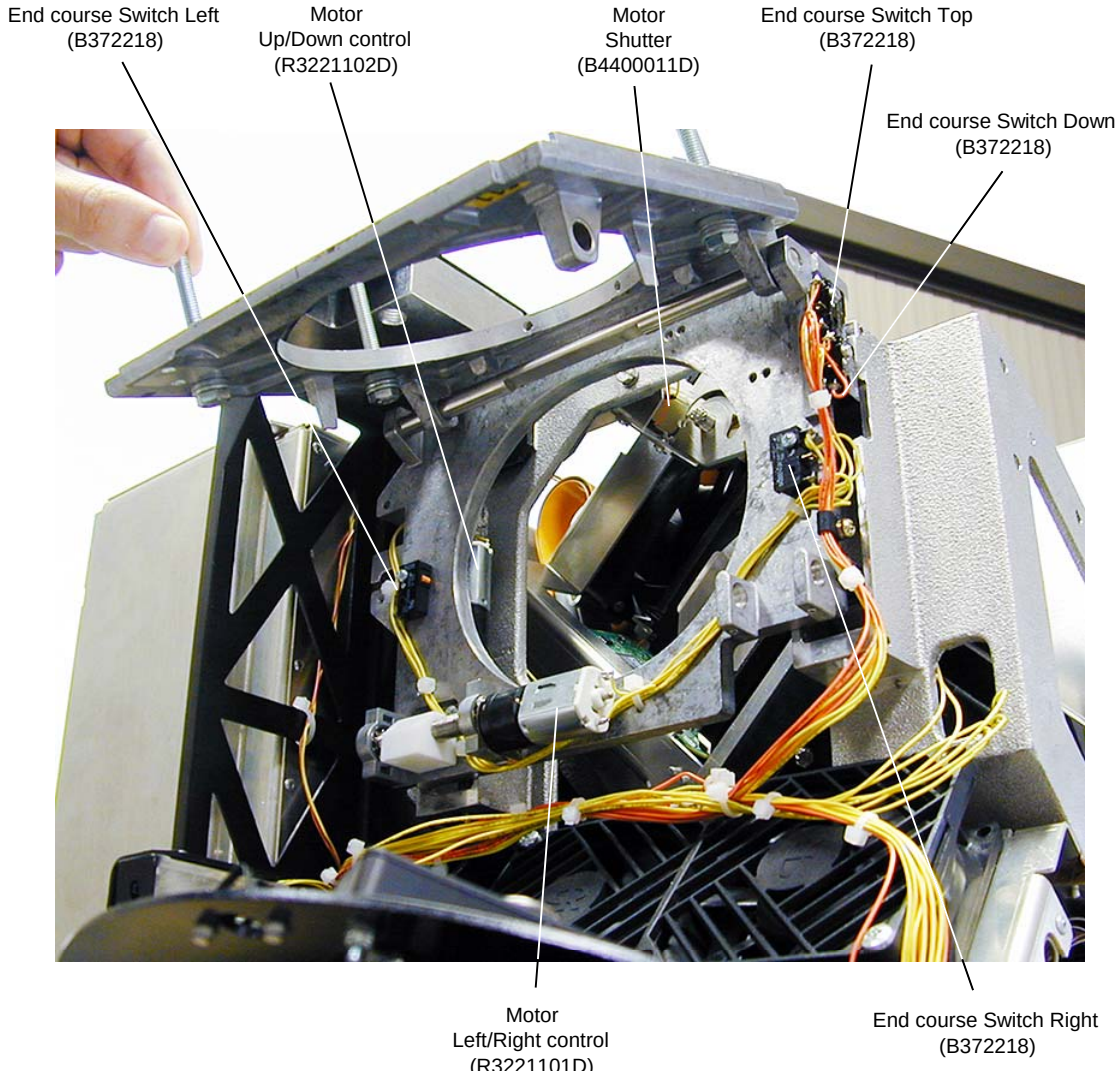


Image 27-1
Overview Micro Switches and Motors on Lens Block

27.1.2 Disassembling the Lens Block

Removing the Lens Holder Front Plate

1. Remove the 4 nuts (C) holding the lens holder front plate (B) onto the lens holder X-Y plate (E).

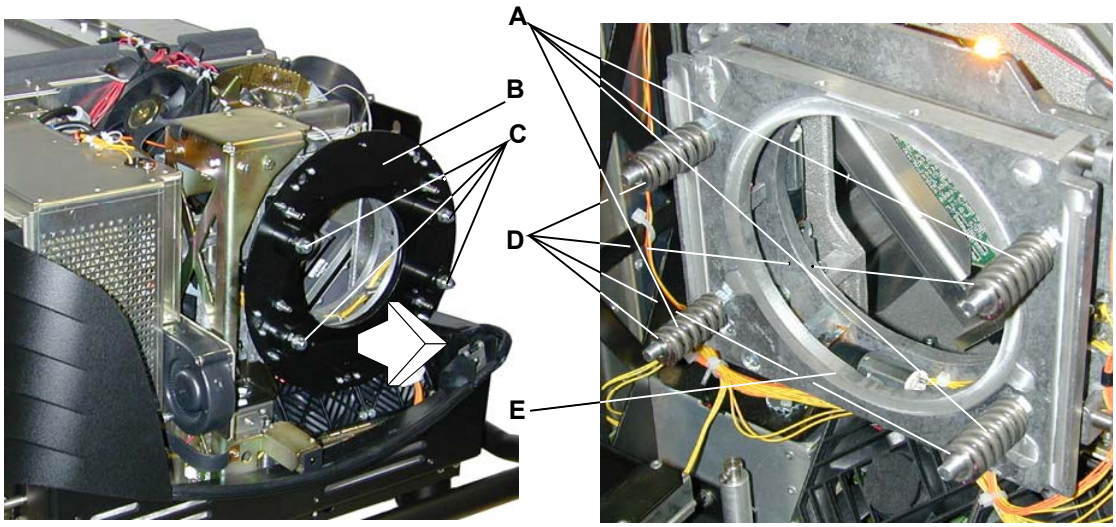


Image 27-2
Removal front plate lens block

2. Remove the lens holder front plate from the fixation bolts.
3. Remove the 4 springs (A) and the 3 washers (D) from the fixation bolts (to be reused when reassembling)

Tilting the Lens block X-Y Plate

1. Loosen the 2 hexagon socket screws (A) securing the hinge (B) into place.

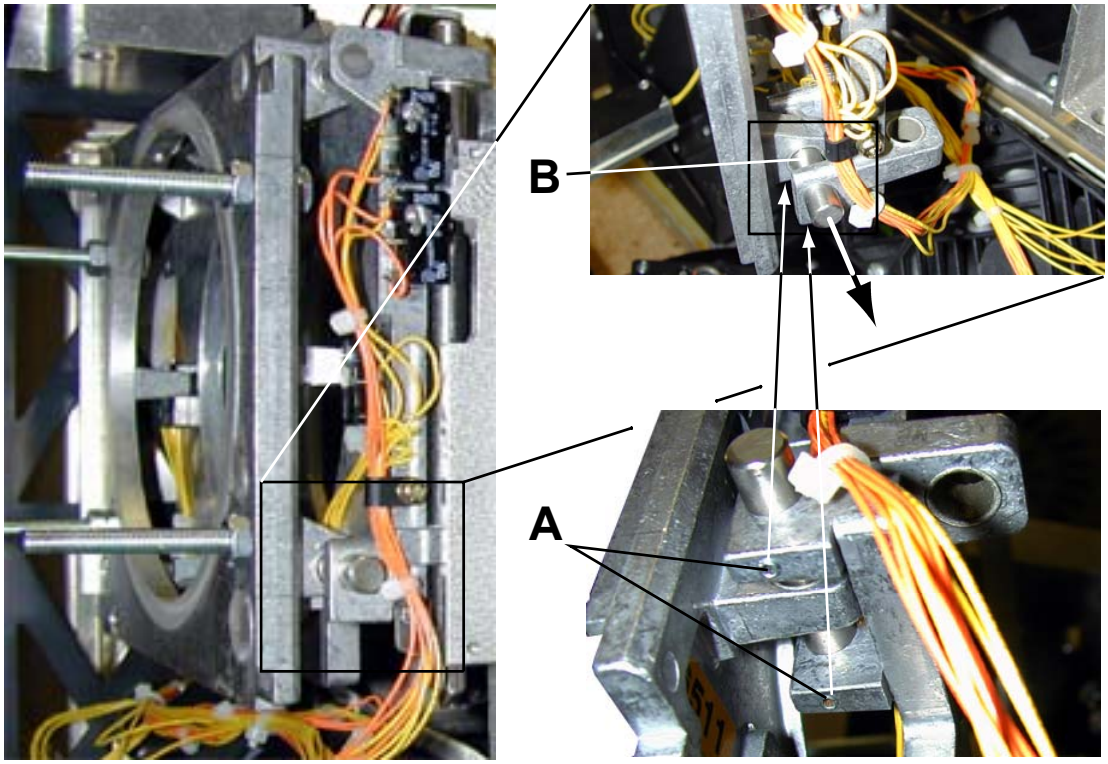


Image 27-3
Hinge removal

2. Pull out the hinge.
3. Remove the 2 screws (C) fixing motor axle block (D) onto lens block X-Y plate.

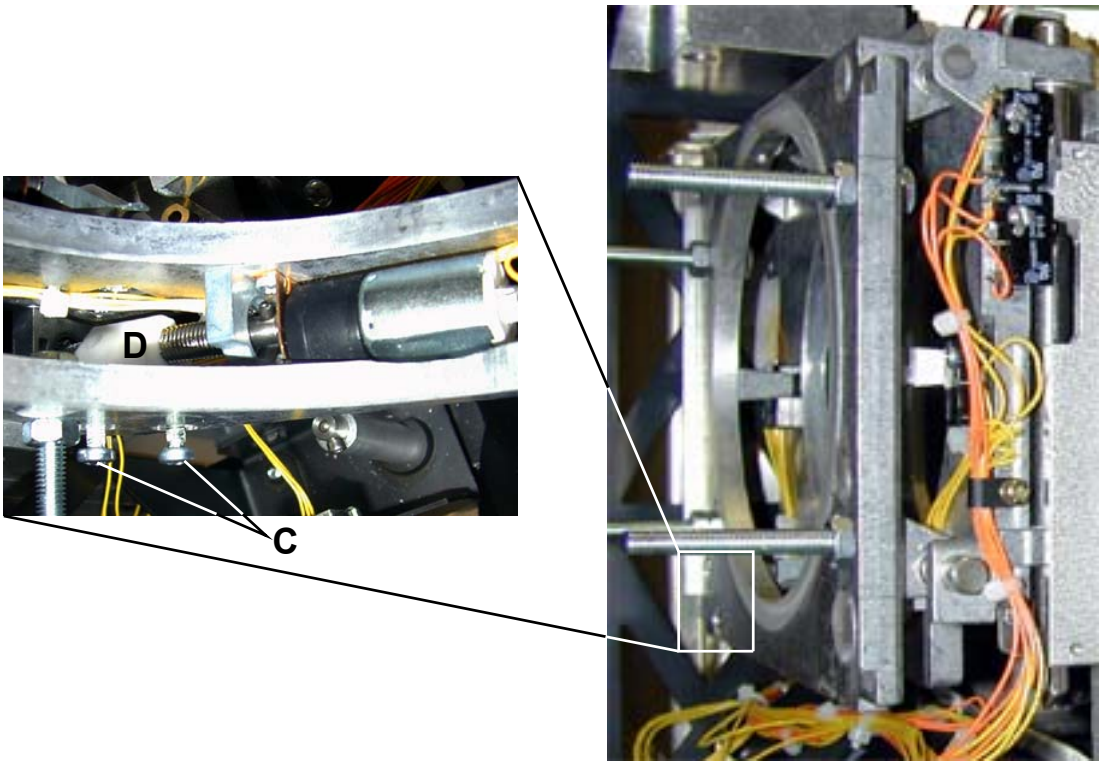


Image 27-4
Loosening motor axle block

4. Lift up the lens block X-Y plate (E) to access the motor units Left/Right (F) and the end course micro switches Left/Right (G).

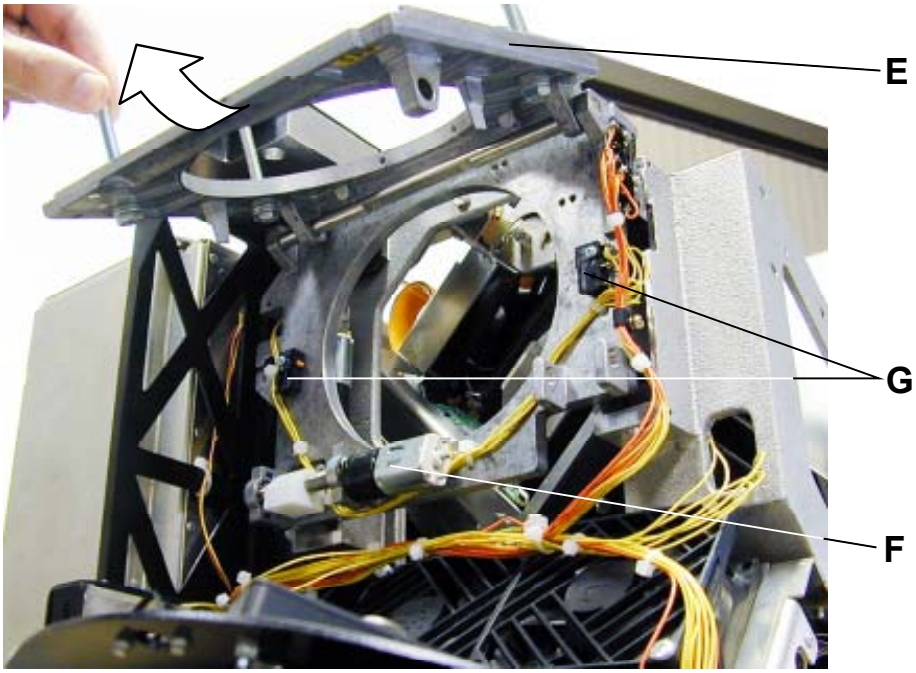


Image 27-5
Opening lens block

27.1.3 Disassembling a Motor Unit

Motor Unit Up/Down

1. Loosen the hexagon socket screw (A) fixing the motor axle onto the worm gear.

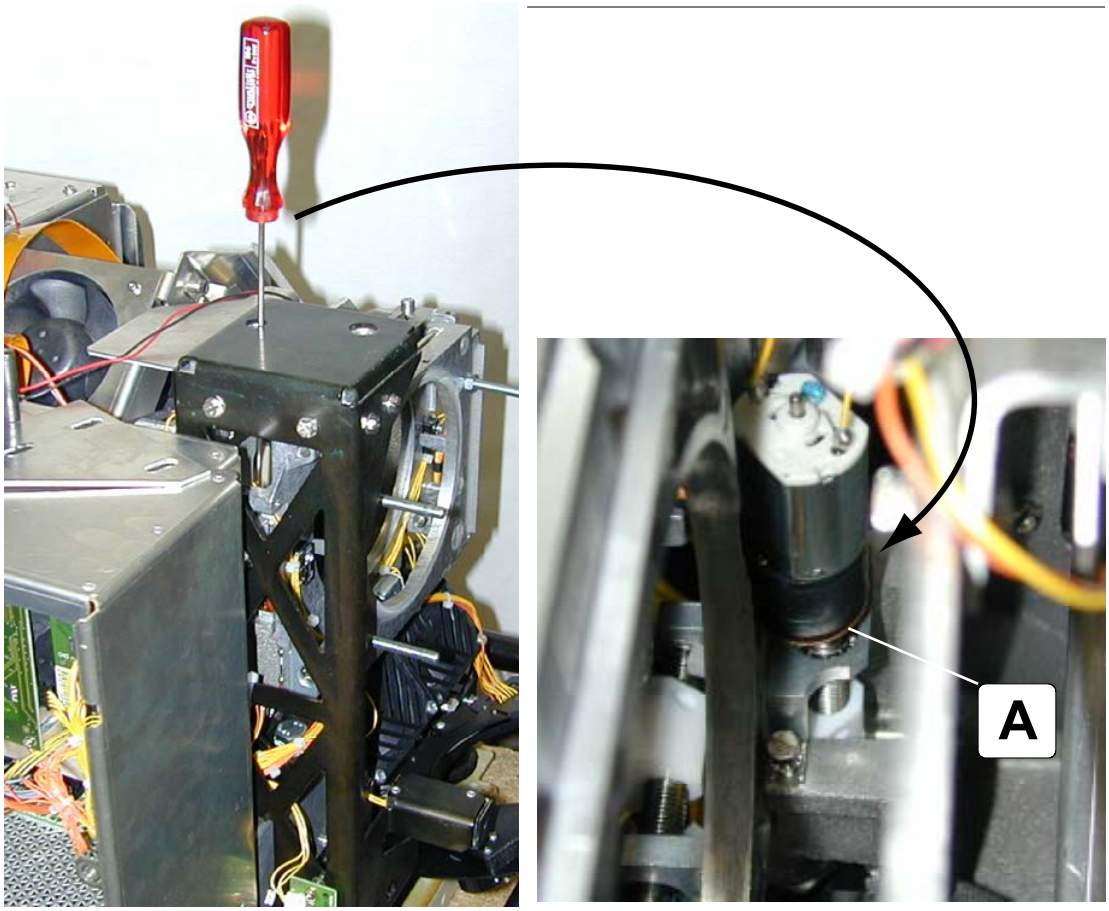


Image 27-6
Removal motor Up/Down shift

2. Remove the screw (B), accessible through a hole (C) on top of the mechanical frame, fastening the copper motor support (C) onto the lens block.

3. Remove the motor unit for replacement.
   Caution: *When fixating the copper motor support onto a new motor, be careful not to turn the 2 fixation screws deeper than the thickness of the motor reduction unit.*

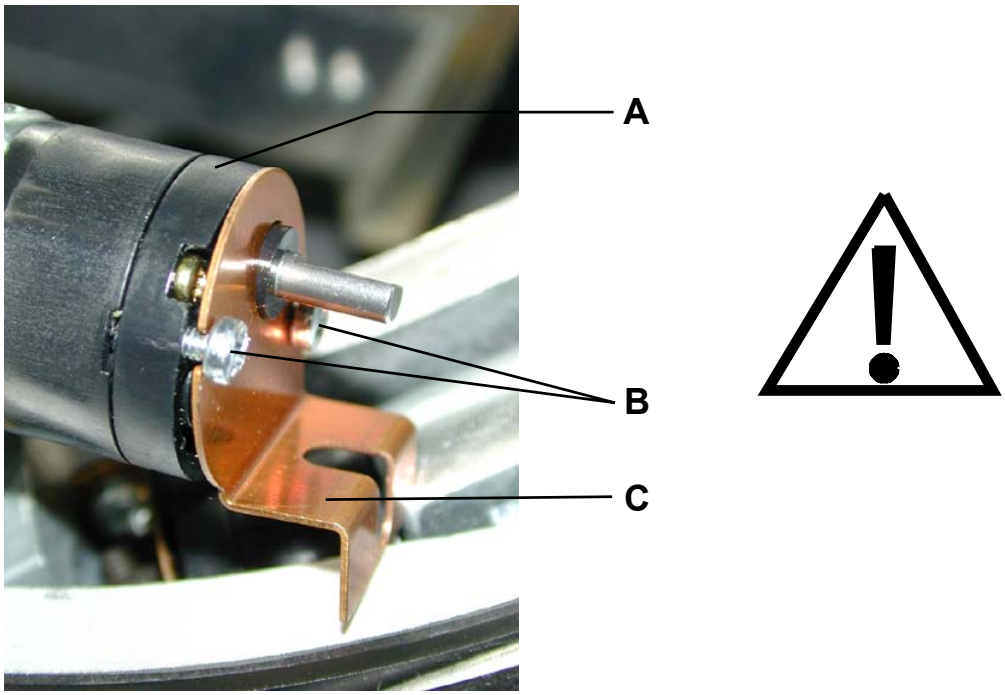


Image 27-7
Mounting motor copper support

Motor Unit Left/Right

1. Loosen the hexagon socket screw (A) fixing the motor axle onto the worm gear.

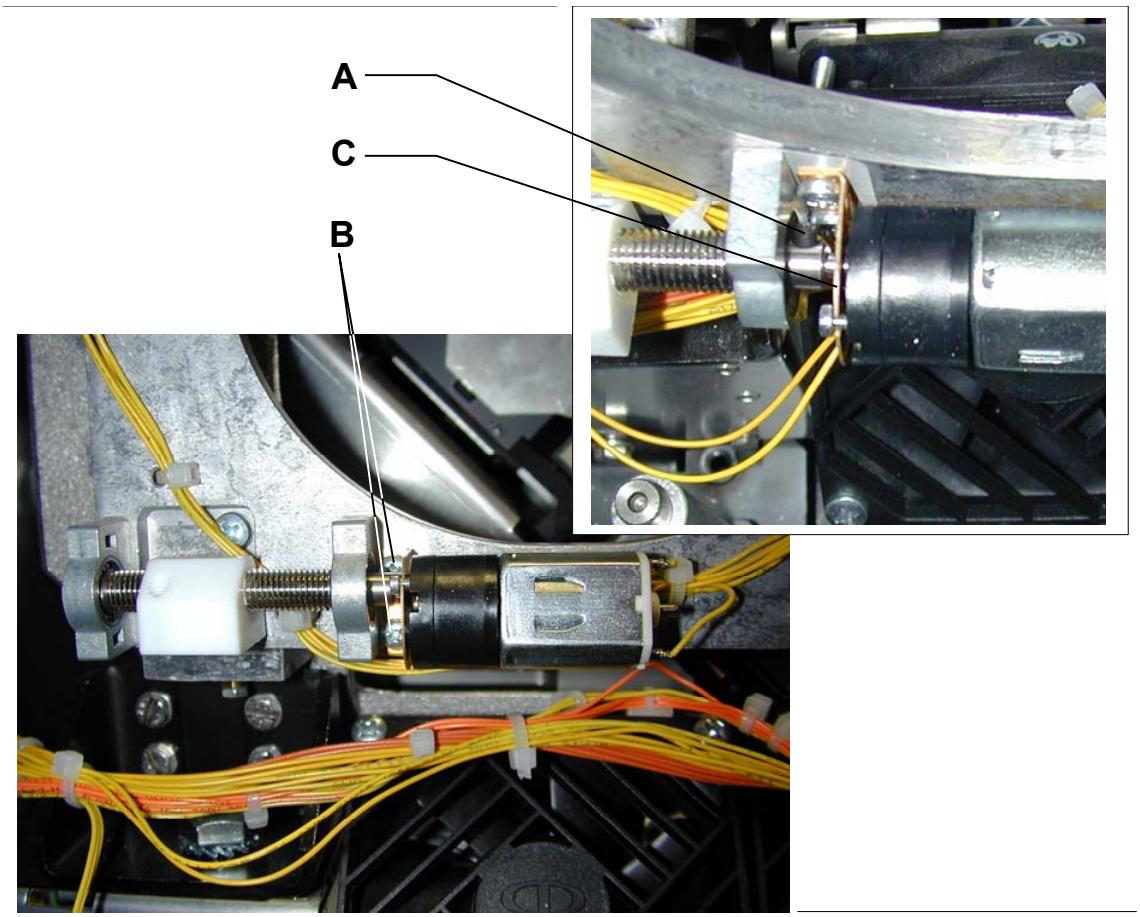


Image 27-8
Removal motor Left/Right shift

2. Remove the 2 screws (B) fastening the copper motor support (C) onto the lens block (D).
3. Remove the motor for replacement.
   Caution: *When fixating the copper motor support onto a new motor, be careful not to turn the 2 fixation screws deeper than the thickness of the motor reduction unit (Illustration: see Motor unit Up/Down).*

27.2 Cleaning/Replacement of the Dust Filters

CAUTION: Always turn off the projector before proceeding to dust filter cleaning or replacement.

To avoid contaminating the projector with its removed dust filters, clean the dust filters far away from the projector or by preference clean the filters in another room.

Cleaning frequency

The cleaning frequency of the dust filters depends on the environment conditions. In any case, the dust filters must be cleaned whenever you replace the lamp. In case the projector operates in a dusty or dirty environment, step up the cleaning frequency of all dust filters, e.g. every 2 months. A clogged filter reduces air flow, and can lead to overheating and failure of the projector.

To guarantee maximum operating performances of the projector, **ALWAYS** replace damaged filters and too contaminated filters.

Overview

- Location of the Dust Filters
- Cleaning/Replacement of the Dust Filters

27.2.1 Location of the Dust Filters

Where mounted?

To protect the projector against internal contamination due to forced air cooling, dust filters are mounted at the air inlet of the projector. Therefore 2 casings are mounted on the projector, one on the front (a) and the other on the rear (B), containing an air filter.

Image 27-9
Location of the dust filters

A Dust filter at the front side of the projector
B Dust filter at the rear side of the projector

Order number Air filters

Order No	Description
R8454096k	Air filter – 6 pack
R84540924K	Air filter – 24 pack

27.2.2 Cleaning/Replacement of the Dust Filters

27.2.2.1 Dust filter on the front side of the projector

Necessary tools

Philips screwdriver P1 or Flat blade screwdriver of 5 mm.

How to Remove!

1. For a table mounted projector, put one hand (A) under the filter casing (Dust filter will drops when the captive screws are loosened).

Image 27-10
Release dust filter at front side

2. Loosen the 4 captive screws (B) securing filter casing to projector front.

The dust filter is released and can be removed (C) for cleaning or replacement.

Image 27-11
Removing dust filter from its casing

How to clean!

1. Put the dirty air filter far away from the projector or preferable in another room.
2. Brush most of the dust off with a soft brush and/or blow dust away with compresses air.
   Tip: *Always replace damaged and/or too dirty air filters by a new one.*

How to reinstall the cleaned or new air filter

1. Slide the air filter (A) in its casing and hold it in place with one hand (B).

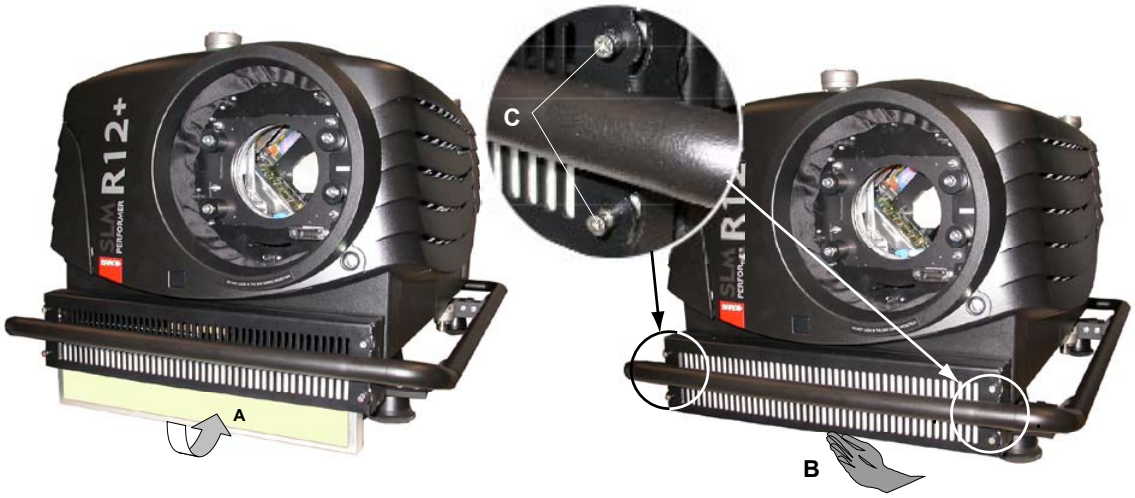


Image 27-12

2. Secure the position of the air filter in its casing by tightening the 4 captive screws (C).

27.2.2.2 Dust filters on the rear side of the projector

Access to the air filters

To access the air filters on the rear of the projector, first the projector rear cover has to be removed.

Necessary tools

Allen key of 3 mm

Removal of the projector rear cover

1. Turn the 3 captive screws, securing rear cover to projector frame, half a turn counterclockwise.

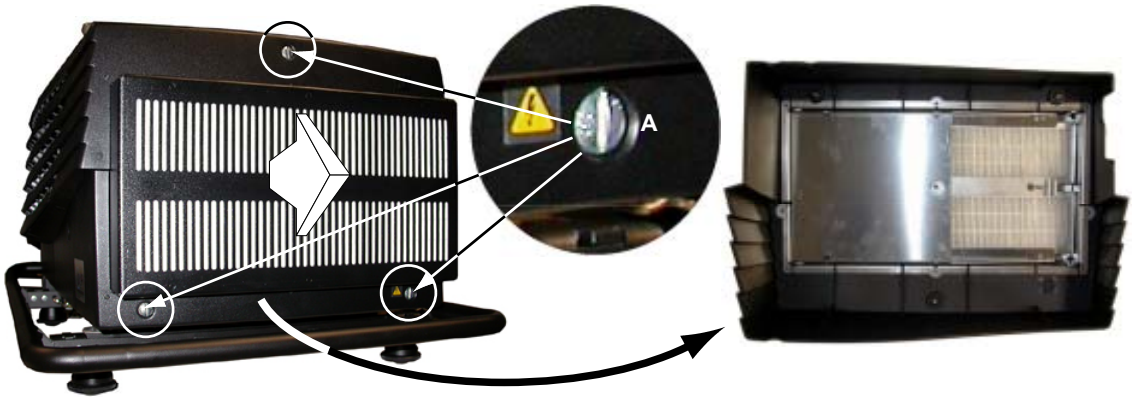


Image 27-13
Projector rear cover removal

2. Remove the rear cover from projector.

Removal of the Air filters

1. Loosen the 6 hexagon socket screws (B) , securing metal fixation plate (A) to rear cover.

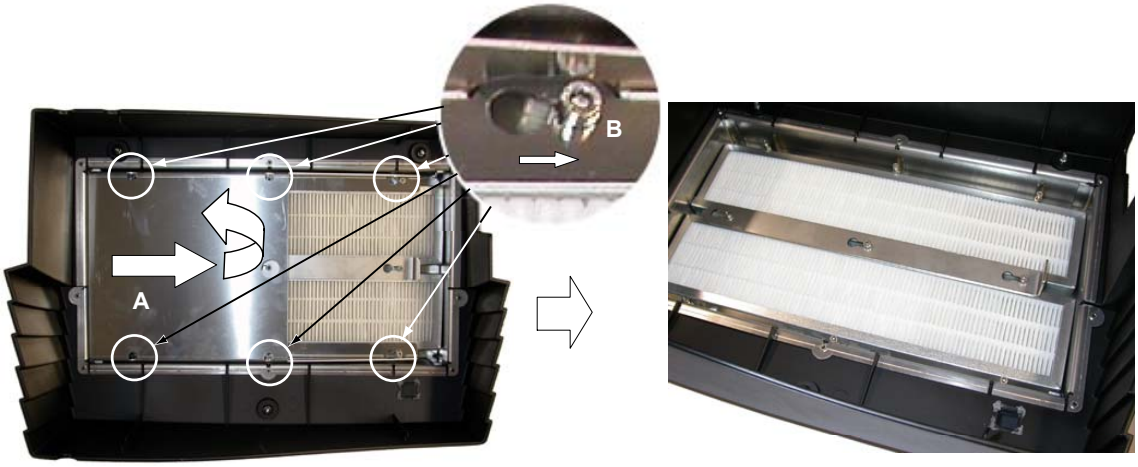


Image 27-14
Removal metal fixation plate

2. Slide the metal fixation plate to the right until the screw head matches the free gap in the plate.
3. Remove metal fixation plate from rear cover.
4. Loosen the 3 hexagon socket screws (C) , securing metal fixation bar (D) to rear cover.

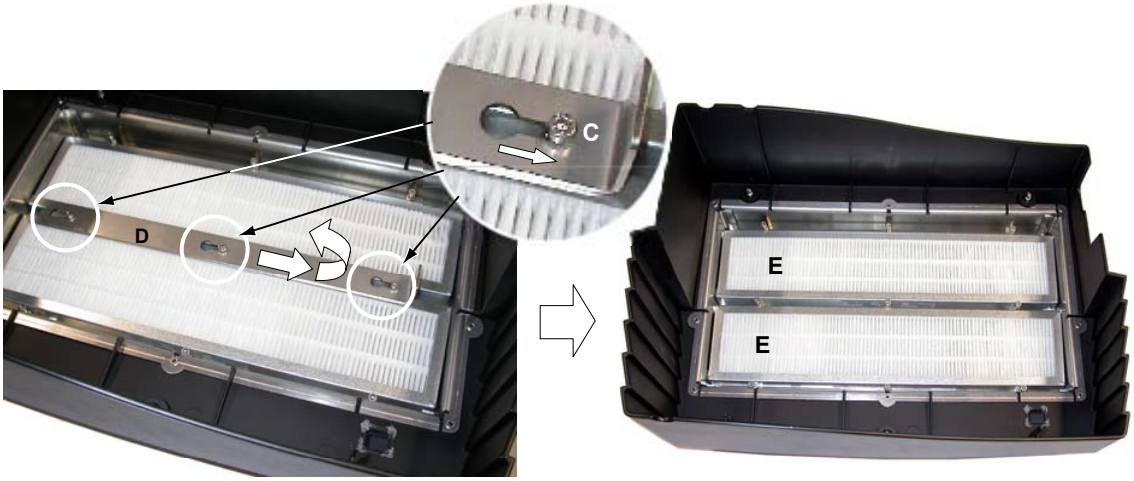


Image 27-15
Removal metal fixation bar

5. Slide the metal fixation bar to the right until the screw head matches the free gap in the plate.

6. Remove metal fixation bar from rear cover.

   Both air filters (E) can be removed for cleaning or replacement.

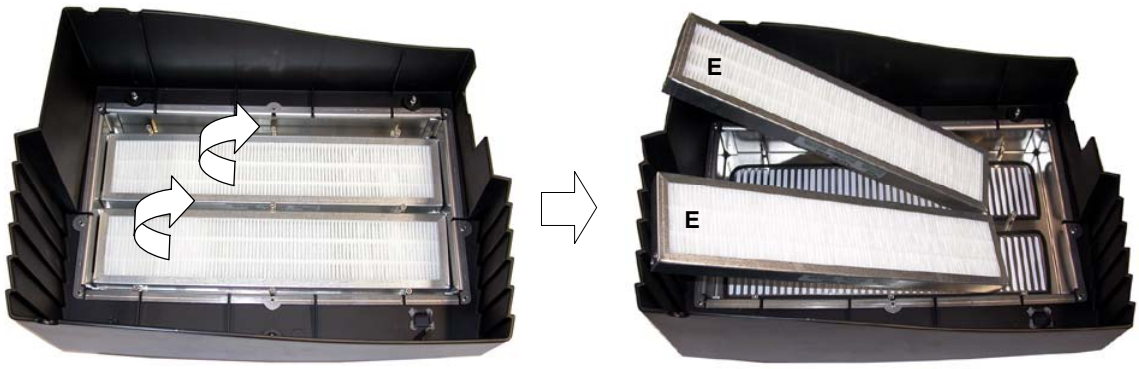


Image 27-16
Air filter removal

How to clean!

1. Put the dirty air filter far away from the projector or preferable in another room.
2. Brush most of the dust off with a soft brush and/or blow dust away with compresses air.
   Tip: *Always replace damaged and/or too dirty air filters by a new one.*

How to reinstall the cleaned or new air filter

1. Place the air filters (A) on their place in the projector rear cover.

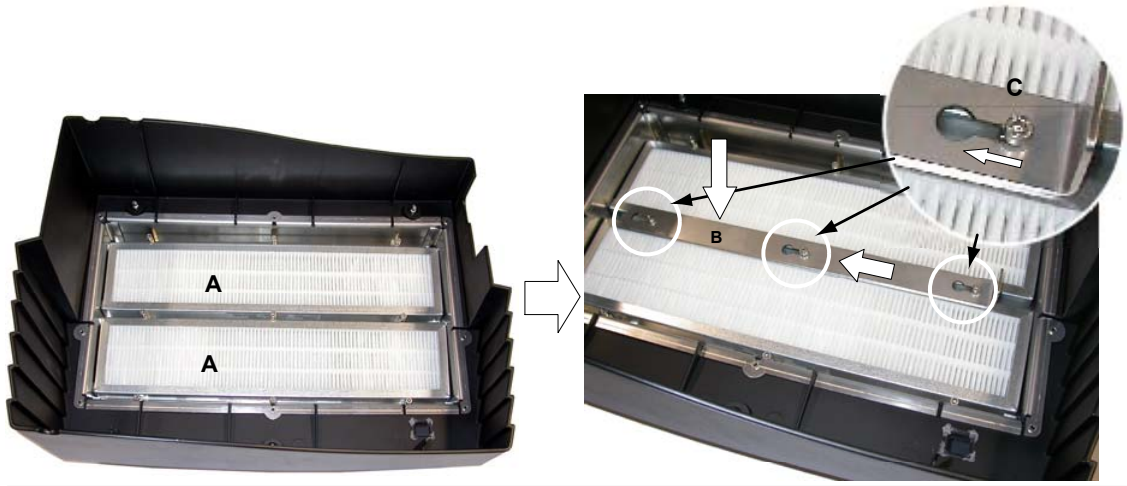


Image 27-17
Mounting the fixation bar

2. Place the metal fixation bar (B) on its place, slide it to the left and secure by tightening the 3 socket screws (C).
3. Place the metal fixation plate (D) on its place, slide it to the left and secure by tightening the 6 socket screws (E).

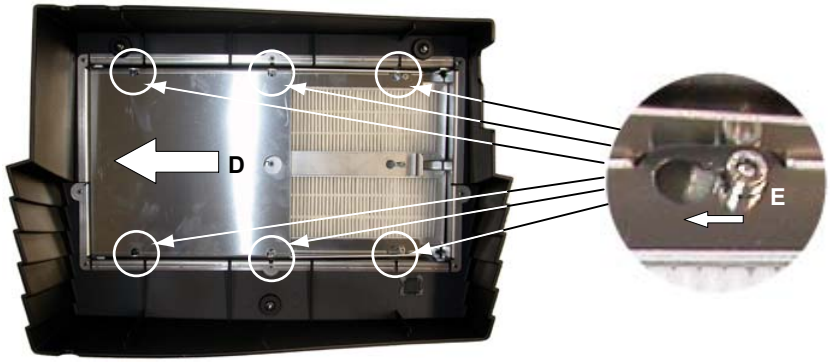


Image 27-18
Mounting the fixation plate

4. Reinstall the rear cover onto the projector and secure by turning the captive screws (A) half a turn clockwise.

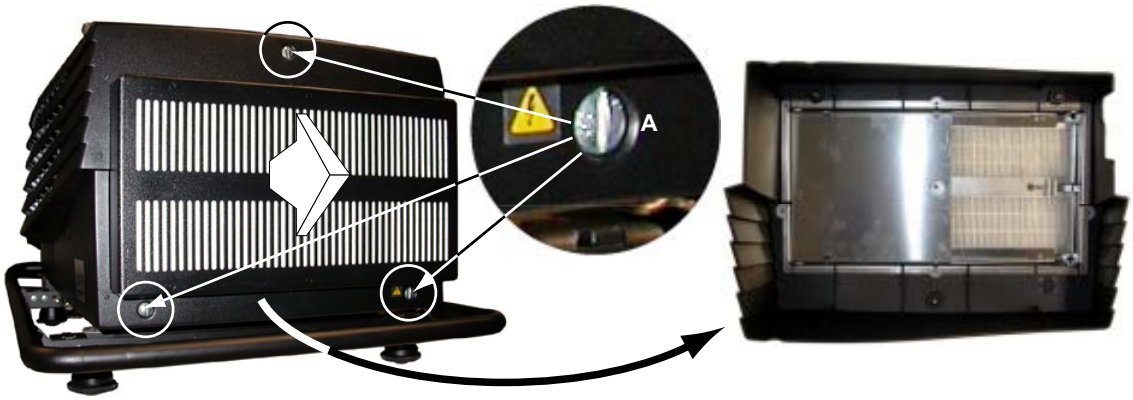


Image 27-19
Mounting the projector rear cover

27.3 Lamp Replacement

27.3.1 Safety Warnings

27.3.1.1 Safety warnings during installation

Who may install

The installation must be performed by authorized technical personnel only.

Authorized technical personnel: persons having appropriate technical training and experience necessary to be aware of hazards to which they are exposed in performing a task and of measures to minimize the danger to themselves or other persons.

Caution risk of electric shock

Before attempting to remove any of the projector's covers, the projector has to be turned off and disconnected from the wall outlet to minimize the risk of electric shock.

Caution on head

Before starting with the replacement of the lamp unit, always let cool down the projector after operation in order to reduce the heat on parts in the light path and to avoid burns.

Warning eye damage

Eye damage may result from direct viewing the light produced by the lamp used in this equipment. Always turn off lamp before opening cover.

27.3.1.2 Product care

Installation Kit

The universal lamp replacement Kit **R9841810** is designed for use ONLY with the BARCO SLM G8/R8, G10/R10, R9+ and R12+ series projectors.

Replacement parts

When replacement parts are required, be sure the service technician has used original Barco replacement parts or authorized replacement parts which have the same characteristics as the Barco original part.

Unauthorized substitutions may result in degraded performance and reliability, fire, electric shock or other hazards. Unauthorized substitutions may void warranty.

Repairable

Under no circumstances are Barco parts repairable by anyone other than Barco.

27.3.2 Introduction

27.3.2.1 Content of the kit

Content of the kit

The lamp kit consists in a lamp housing, Xenon lamp included. That means that the lamp position is factory calibrated following the X- ,Y- and Z-axis. When observing a decrease in light output during the run time of the lamp, ONLY a realignment following the Z-axis can solve the light output decrease.

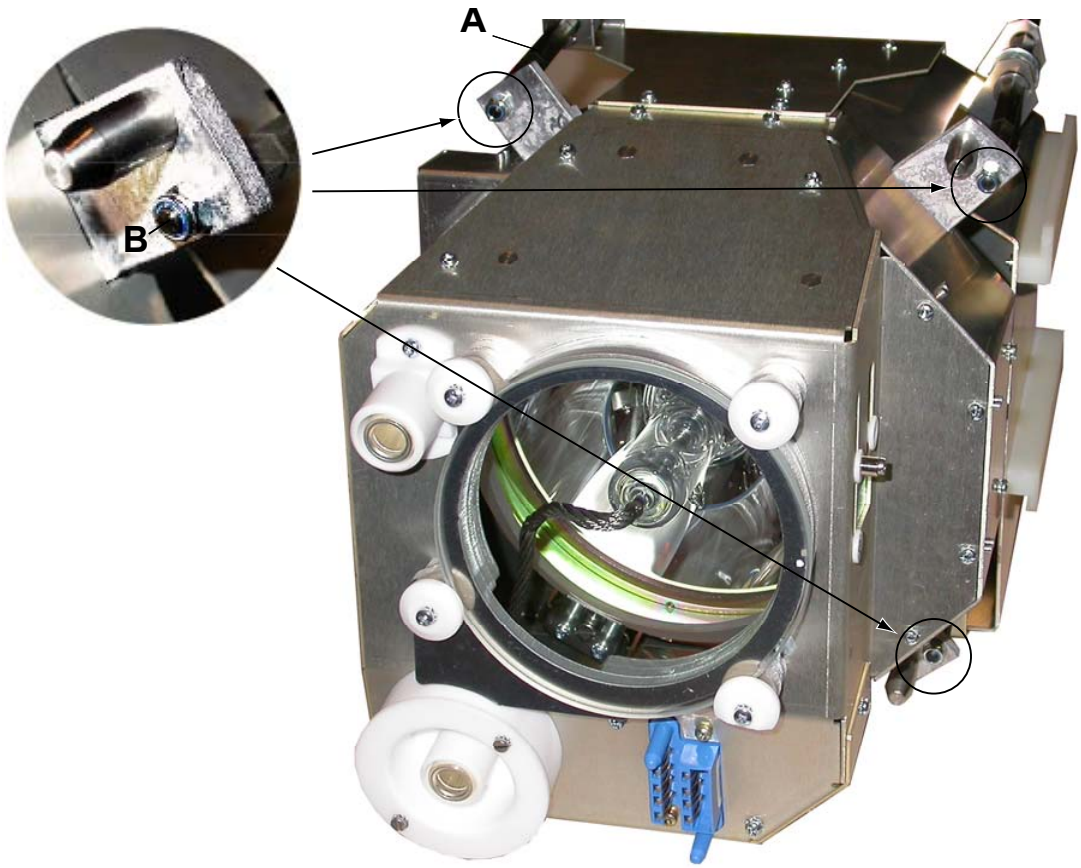


Image 27-20
Spacers lock nut removal

Only for transport purposes, the 3 lamp housing fixation spacers (A) are fixed to the lamp casing frame by a lock nut M5 (B). Always remove the lock nuts before inserting the lamp housing into the projector

27.3.3 Removing the old lamp

27.3.3.1 Access to the Lamp Unit.

What has to be done

To access the lamp casing, a side panel has to be removed.

Necessary tools

A flatblade screwdriver of 5 mm

Removing the side panel

1. Turn with a screwdriver the side panel lock screw (A) a quarter turn counter clockwise.

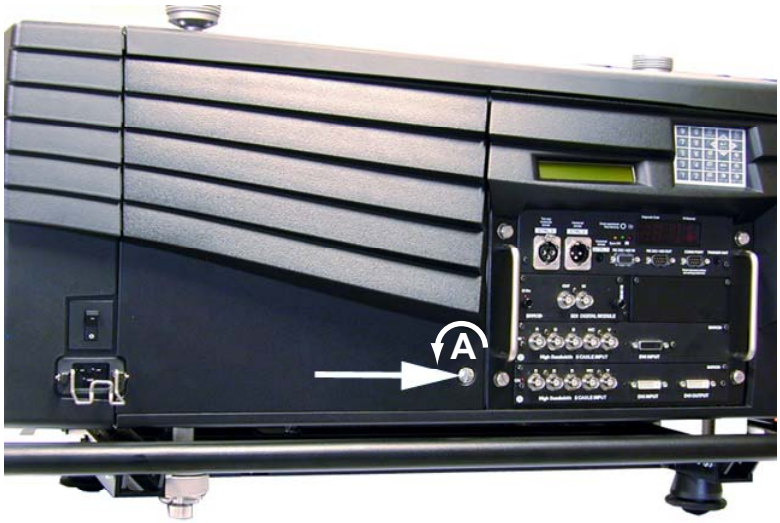


Image 27-21
Unlocking the side cover

2. Pull the right side of the panel towards you and next to the right to remove.

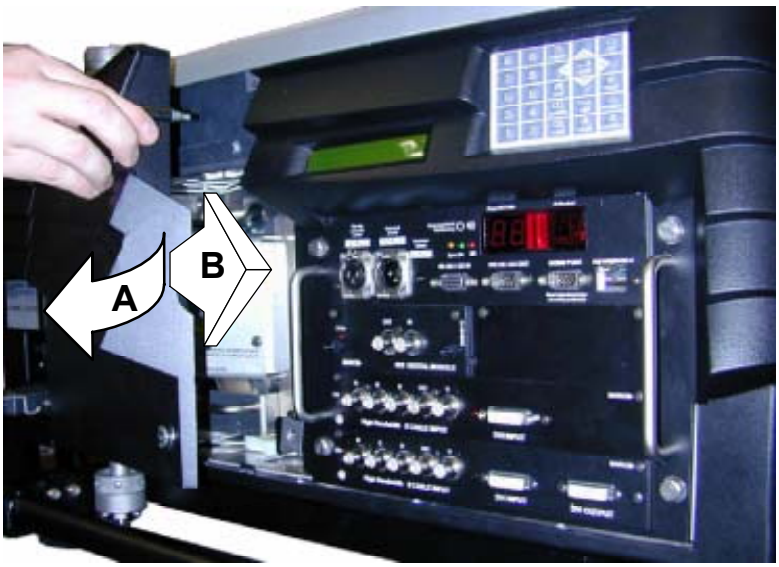


Image 27-22
Lamp cover removal

27.3.3.2 Removing the Lamp Unit.

What has to be done

The lamp unit has to be slid out of the projector frame.

Necessary tools

Flatblade screwdriver of 5mm or Nutdriver of 8mm.

Sliding out the lamp unit

1. Loosen the 3 spacer screws (A) on the lamp house.

Image 27-23
Loosening the spacer screws

2. Using the provided handle (B), pull the lamp unit out of the projector frame.

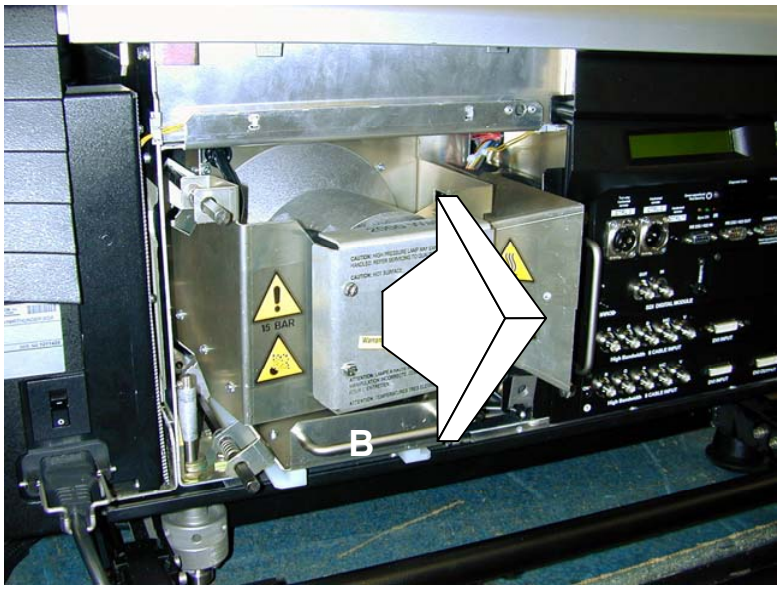


Image 27-24
Sliding out the lamp housing

Caution: *Be careful not to drop the lamp unit (see safety instructions in front of instruction manual)*

27.3.4 Inserting the new lamp Unit

27.3.4.1 Installation of the new Lamp Unit.

What has to be done

First remove the lock nut on each spacer screw and next slide the lamp unit into the projector frame.

Necessary tools

Flatblade screwdriver of 5mm or Nut driver 8mm

Installing the lamp unit

1. Remove the lock nut (B) on the 3 spacer screws (A).

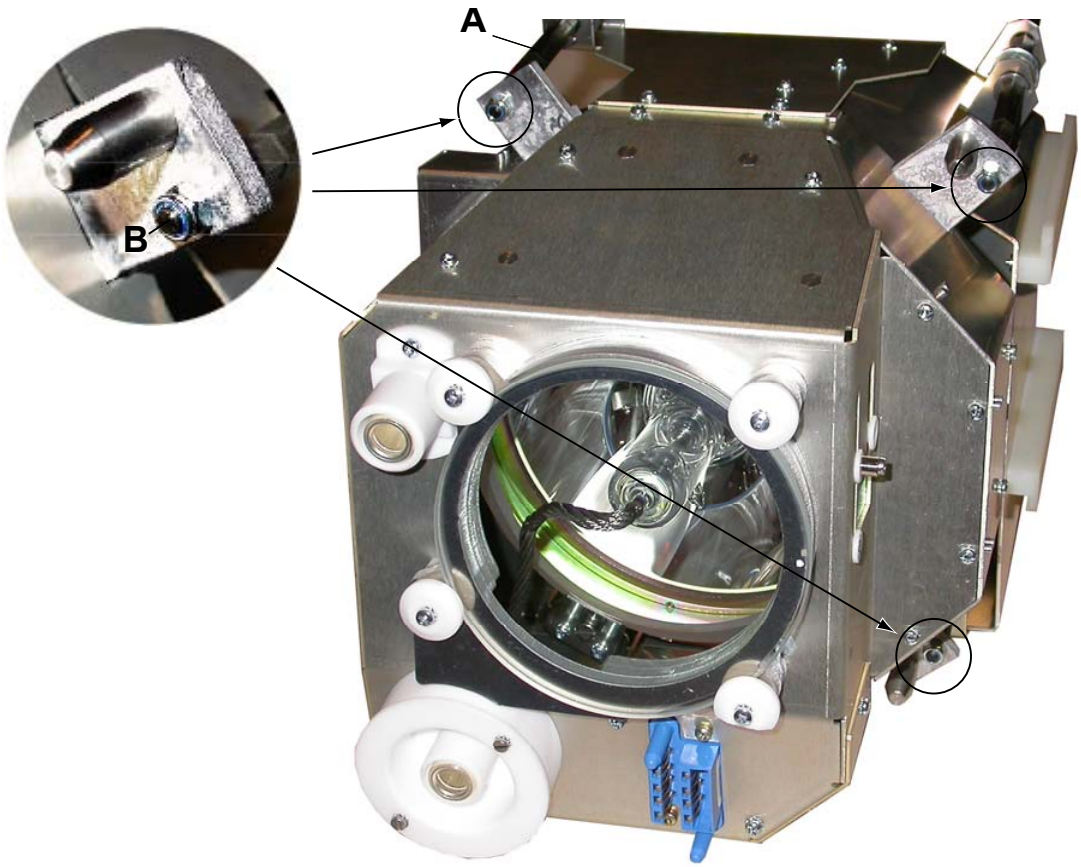


Image 27-25

2. Line up the lamp unit guides (A) with the guides on the projector base (B) and push the unit into the frame until it fits.

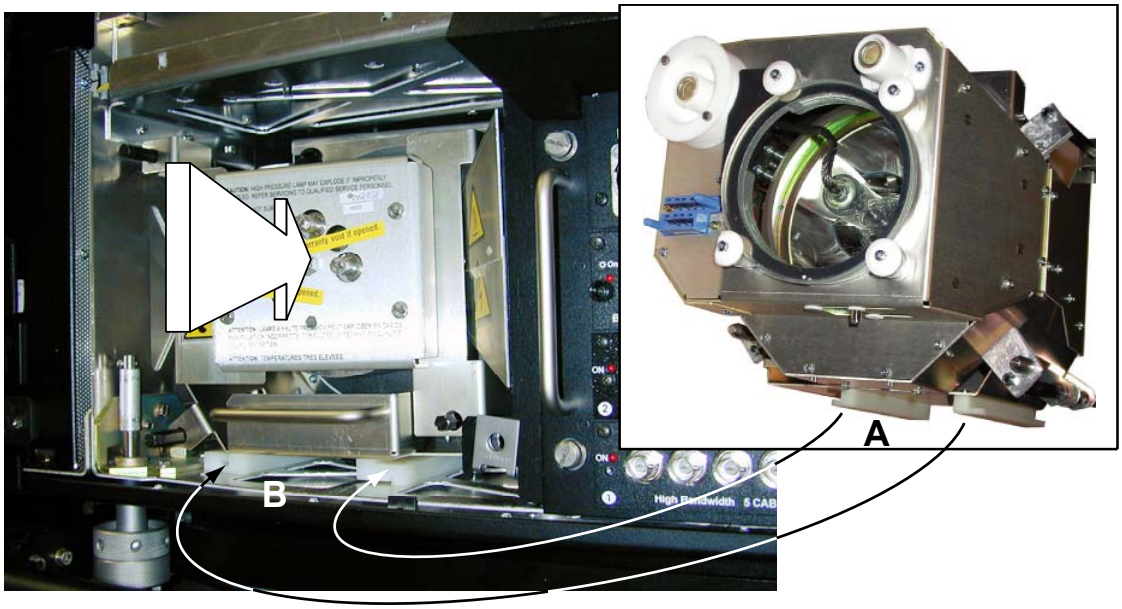


Image 27-26
Lamp unit mounting

3. Secure the position of the lamp unit with the 3 spacer screws.

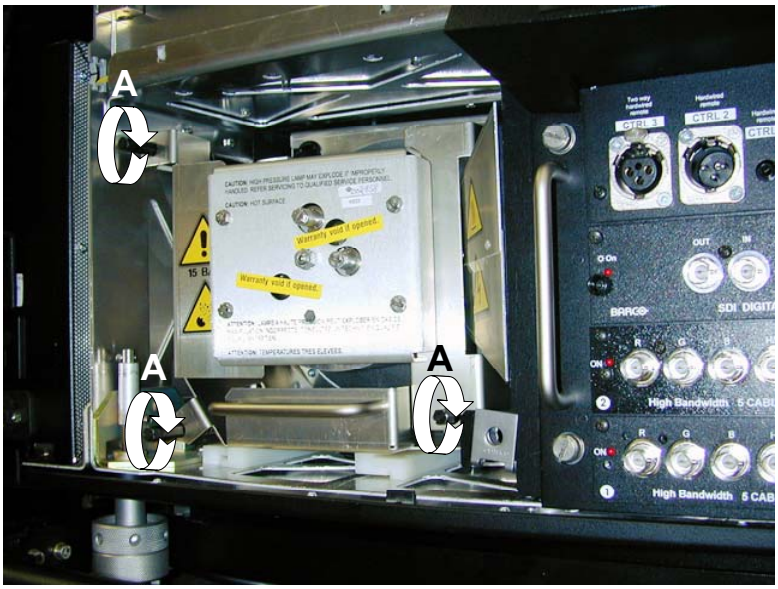


Image 27-27
Lamp unit fixation

27.3.4.2 Optical Alignment of the lamp

What may be adjusted!!

The adjustments to the Y-axis and X-axis (balancing the light intensity) are **FACTORY PREADJUSTED**. Consequently, both adjustable screws are anchored by a lock screw and sealed with a warranty label (Destroying the label void the warranty).

ONLY the Optical readjustment to the Z-axis may be done and is recommended after the lamp has operated for many run times. An optical realignment of the lamp to the z-axis could compensate the decrease in light output.

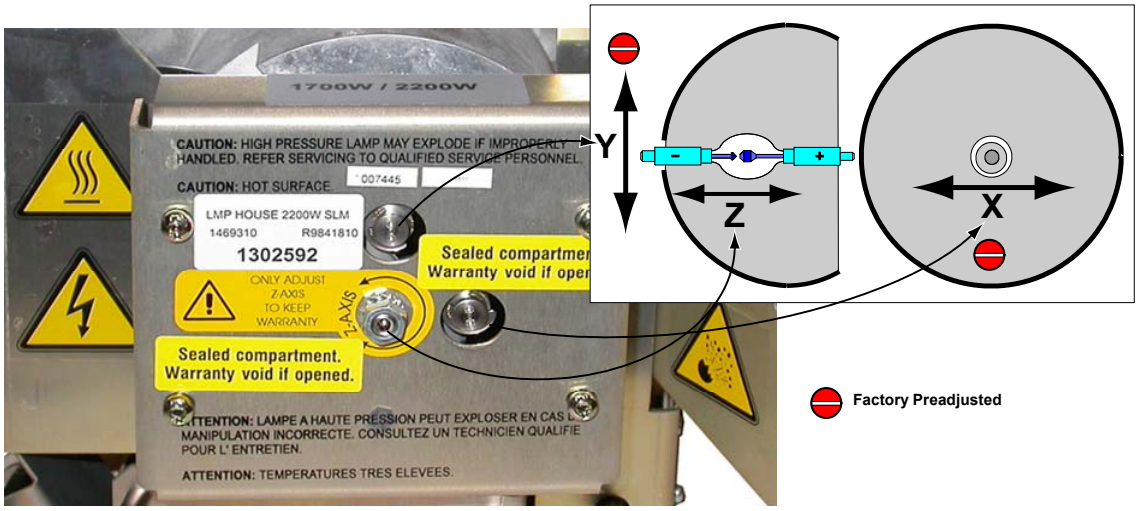

1700W / 2200W
CAUTION: HIGH PRESSURE LAMP MAY EXPLODE IF IMPROPERLY HANDLED. REFER SERVICING TO QUALIFIED SERVICE PERSONNEL
CAUTION: HOT SURFACE
LMP HOUSE 2200W SLM
1469310 R9841810
1302592
ONLY ADJUST Z-AXIS TO KEEP WARRANTY
Z-AXIS
Sealed compartment. Warranty void if opened.
ATTENTION: LAMPE A HAUTE PRESSION PEUT EXPLOSER EN CAS DE MANIPULATION INCORRECTE. CONSULTEZ UN TECHNICIEN QUALIFIE POUR L' ENTRETIEN.
ATTENTION: TEMPERATURES TRES ELEVEES.
Y
Z
X
Factory Preadjusted

Image 27-28
Optical alignments scews

Necessary tools

- Allen Key 3mm
- nut driver 10mm

How to adjust

Optical alignment of the lamp to the z-axis, follow the next procedure:

1. Put a lightmeter in the center of the screen.
2. Enter the ‘RANDOM ACCESS ADJUSTMENT MODE’, select consecutively ‘Picture Tuning’ and ‘Colour Temperature’. Finally set Colour Temperature on ‘PROJECTOR WHITE’.
3. Enter the ‘INSTALLATION MODE’ and select ‘Internal Patterns’. Finally set Internal patterns on ‘PURITY’.

4. Enter the ‘SERVICE MODE’ and select ‘Add-Ins’. Finally set CLO on ‘INACTIVE’.
5. Loosen the lock nut (A), securing the adjustable screw (B) for the optical Z-axis adjustment.

Image 27-29
Optical alignment Z-axis

6. Carefully adjust the adjustable screw (B), using an Allen key of 3mm, for maximum light fall on the screen.
7. Lock the adjustable screw by fastening the lock nut (A).
8. Cancel the above modified projector settings (Step 2 to 4).

27.3.4.3 Reinstalling the Side Panel

What has to be done

After the new lamp unit has been installed, the side panel has to be remounted.

Necessary tools

A flatblade screwdriver of 5 mm

Reinstalling the side panel

1. Move the cover guides under the back cover and push the front of the cover against the projector frame lining up the cover lock screw with the speed nut (A) on the frame.

Image 27-30
Mounting the side cover

Image 27-31
Closing the side cover

2. Turn with a screwdriver the side panel lock screw (B) a quarter turn clockwise to lock.

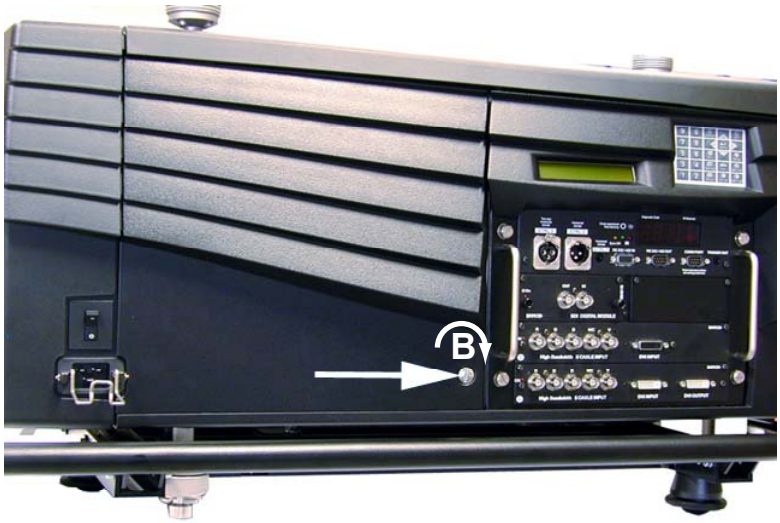


Image 27-32
Locking side panel

27.4 Re-convergence

27.4.1 Re-Convergence Kit

Overview

- Purpose of the kit
- Contents of the Kit
- Relevant Test Pattern

27.4.1.1 Purpose of the kit

Objective

To limit the return of light engines for small convergence drifts, a kit has been developed for the qualified technician to allow re-convergence the light engine.

As the Red DMD on the light engine is not accessible in the projector, re-convergence Green and Blue DMD has to be performed with the Red convergence pattern as reference.

27.4.1.2 Contents of the Kit

Contents

The pre-convergence kit contains the following tools:

- R847196 - Air outlet (to allow access to the Red DMD).
- R821751 - Screen for Fan (not to be used if the Fan has been disconnected).
- R847204 - 2x Steel screwdriver with 1/16” ended hex blade (.
- R847203 - 1x Steel screwdriver with 0.05” ended hex blade.
- R847205 - 1x Square drive socket with soldered hexagon key of 2.5 mm.

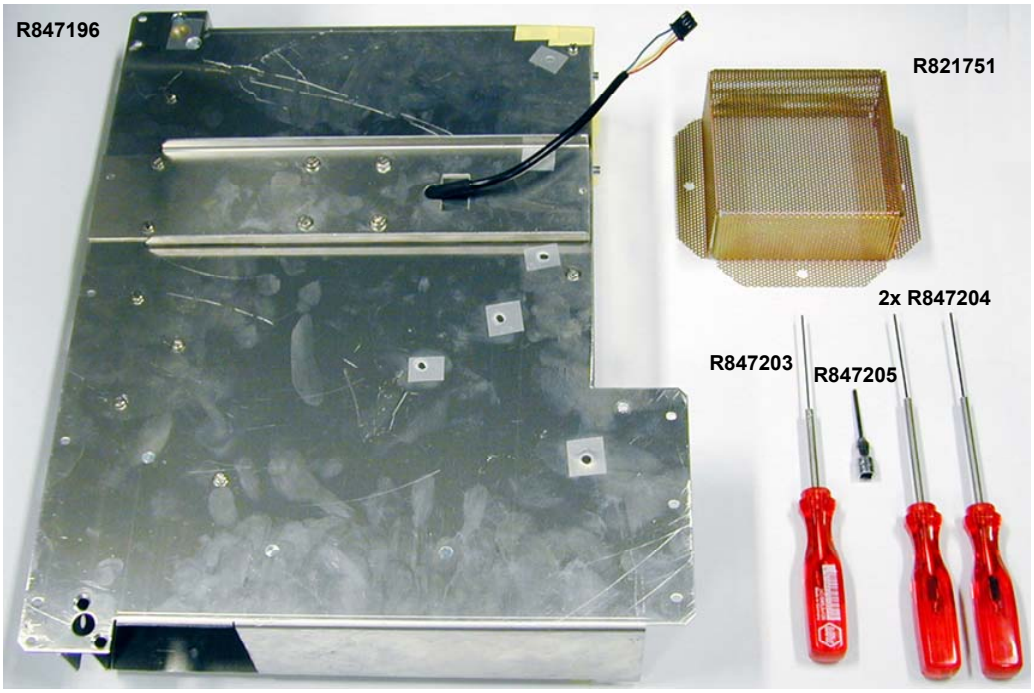


Image 27-33
Contents of the kit

27.4.1.3 Relevant Test Pattern

Display test pattern

1. Press the “*” button on the Remote Control to enter the ’Lens adjustment Zoom/Focus’ mode.

   The lens focus test pattern is displayed with on screen the lens adjustment Zoom/Focus menu. More test patterns are available.

2. Next, press again the “*” button on the Remote Control to select one after the other the available convergence test patterns in the ’Lens adjustment Zoom/Focus’ mode.
   The following 2 test patterns are relevant to re-convergence Green and Blue DMD on the Red DMD (=reference)

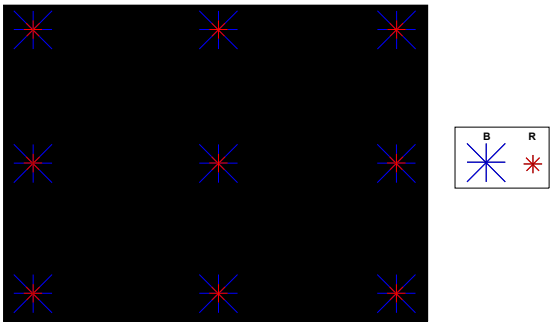


Image 27-34
Convergence test pattern Blue/Red

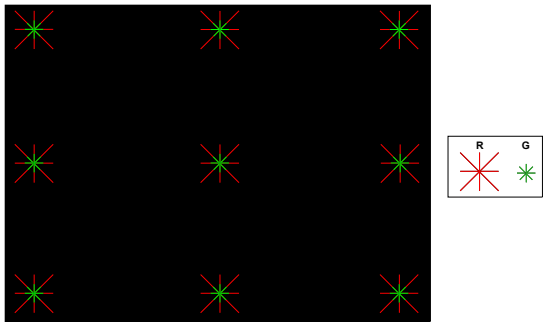


Image 27-35
Convergence test pattern Red/Green

27.4.2 Preparation Projector for Re-Convergence

Overview

- Access to Light Engine
- Disconnection Fans on Light Engine
- Temporarily Replacement of the Air Channel

27.4.2.1 Access to Light Engine

What to do to access the Light Engine

- Removal of the Input Panel box (4 screws to loosen).
- Removal of the back cover (2 spring screws to loosen).
- Removal of the top cover (4 spring screws to loosen and to disconnect the lens dust cloth).

Overview

- Removing the Input Assembly
- Removing the Back Cover
- Removing the top cover

27.4.2.1.1 Removing the Input Assembly

Necessary tools

A flatblade screwdriver of 5 mm

How to remove the Input Assembly

1. Loosen the 4 captive screws (A), holding Input Panel Box to projector main frame.

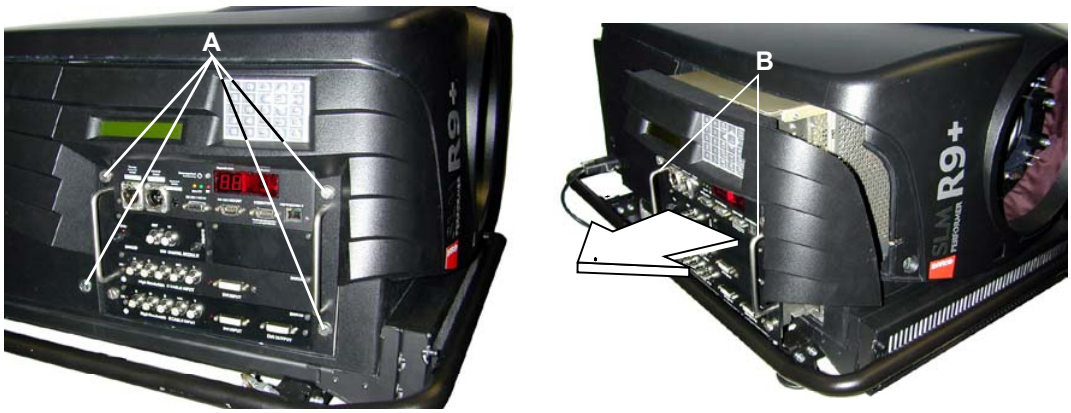


Image 27-36
Removal Input Panel Box

2. Take the input panel by the 2 handles (B) and pull it out the projector.

27.4.2.1.2 Removing the Back Cover

How to remove the Back Cover

1. Loosen the 3 spring screws (A), holding the back cover to projector main frame.

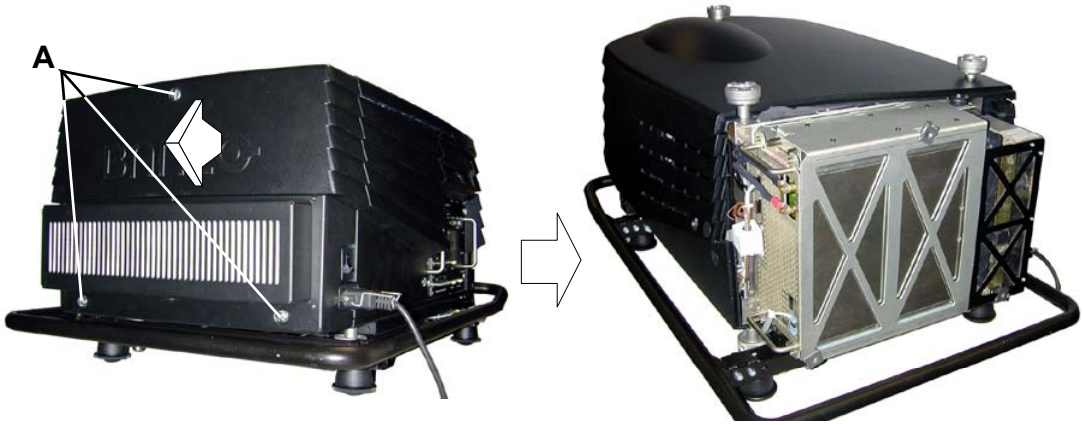


Image 27-37
Removal of the back cover

2. Slide backwards the back cover to remove.

27.4.2.1.3 Removing the top cover

Removal of the stacking points

1. Loosen the fixation bolt of the 3 stacking points on top of the projector, using an Allen key of 8 mm.

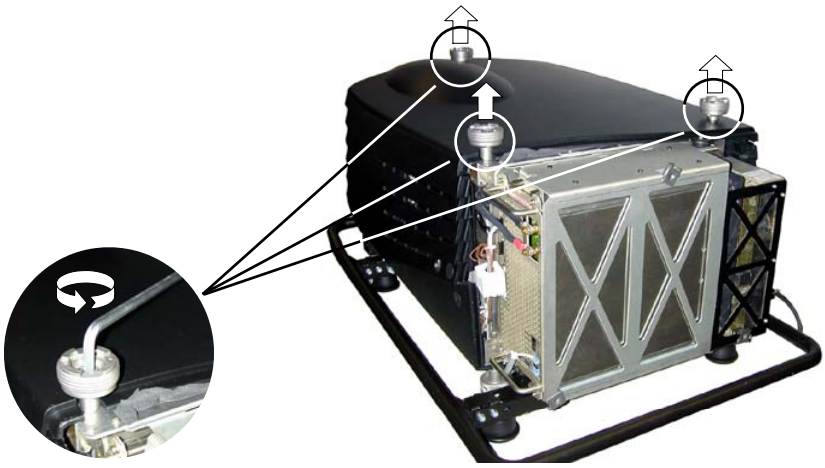


Image 27-38
Removal of the stacking points

2. Remove the 3 stacking points upwards.

Loosening the top cover fixation spring screws

1. Loosen 2 spring screws (3 & 4), holding front of top cover to projector main frame.

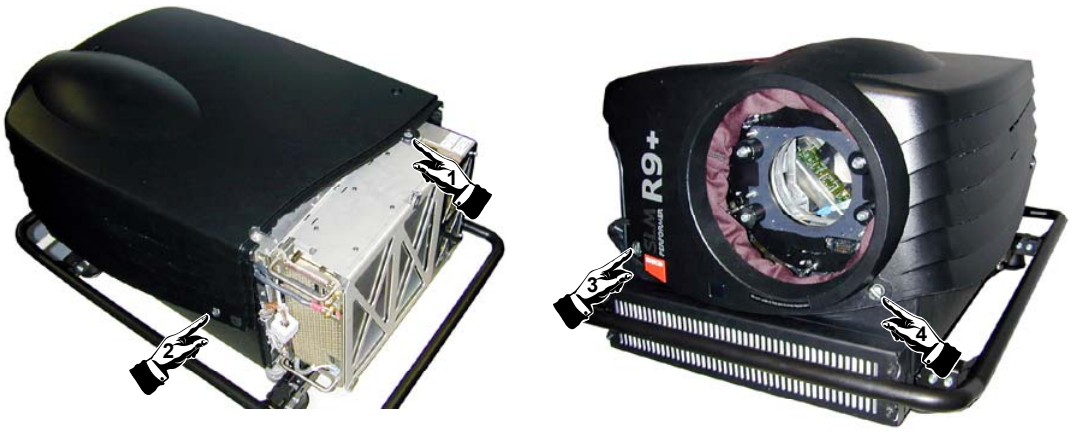


Image 27-39
Top cover fixation spring screws loosening

2. Loosen 1 spring screws (1), holding upper side of top cover to projector main frame.
3. Loosen 1 spring screws (2), holding side of top cover to projector main frame.

Disconnection of the dust protection cloth

1. Hold the lens with one hand and move the lens lock clockwise (picture A).

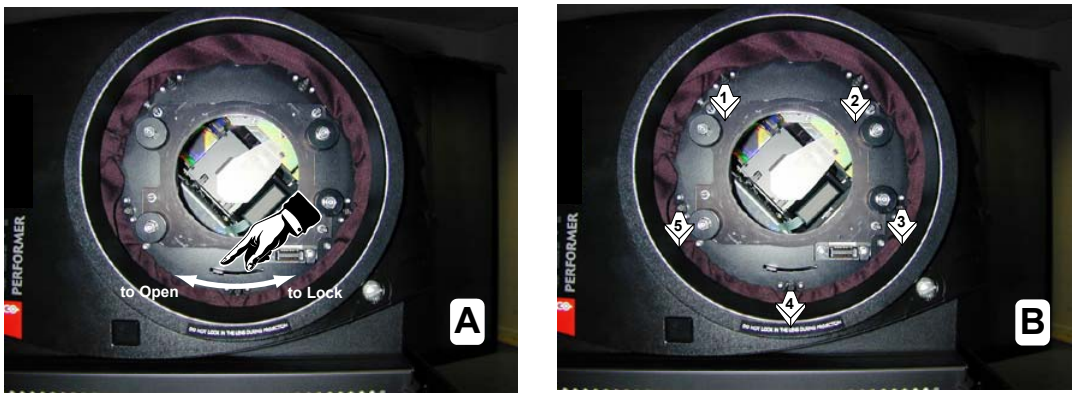


Image 27-40
Removal Lens and dust cloth

The lens lock is unlocked and the lens can be removed from lens block.

2. Disconnect the dust protection cloth ring from lens block by pulling the ring backwards (picture B).

Removal of the top cover

1. Lift up the top cover to remove.

Image 27-41
Top cover removal

2. Put back the Input Panel box (see "Removing the Input Assembly", page 200).

27.4.2.2 Disconnection Fans on Light Engine

Overview

- Removing the Prism Cooling Fan
- Removing the Engine Cooling Fan
- Electrical disconnection of the Fans

27.4.2.2.1 Removing the Prism Cooling Fan

Removal

To access the adjustable screws of the Green and the Blue DMD panel, the prism cooling fan has to be removed.

1. Remove the 3 screws holding the Fan to light engine frame.

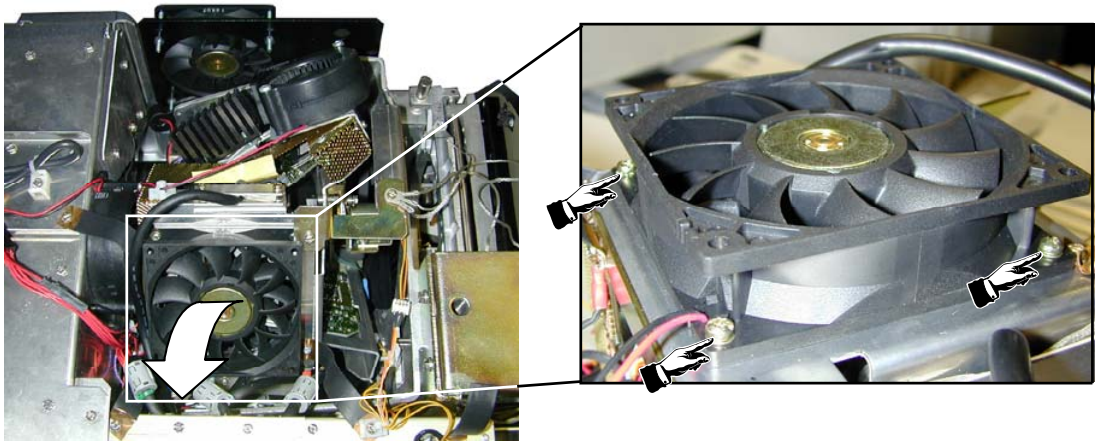


Image 27-42
Removal of the Prism cooling fan

2. Take away the Fan from light engine.

27.4.2.2.2 Removing the Engine Cooling Fan

Removal

To access the adjustable screws of the Green and the Blue DMD panel, the engine cooling fan has to be removed

1. Remove the 3 screws holding the Fan assembly to light engine frame.

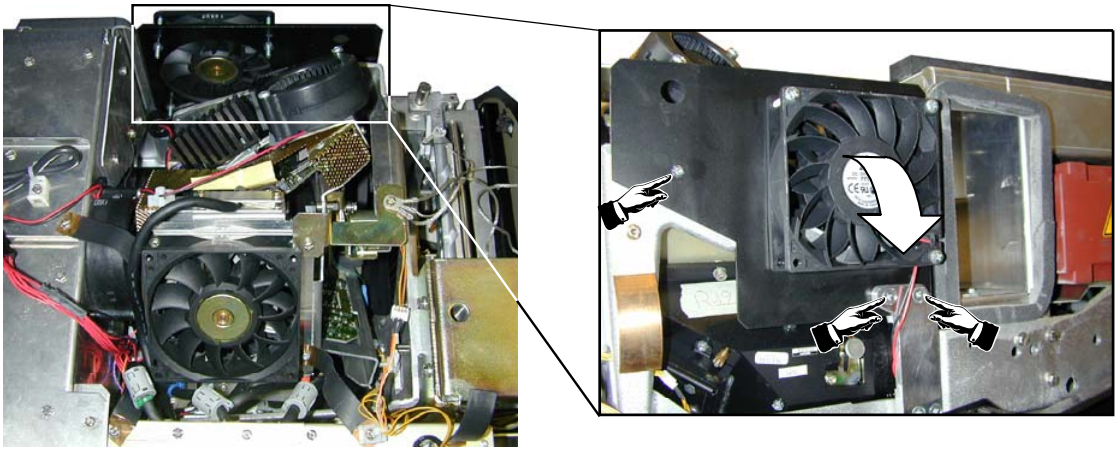


Image 27-43
Removal of the Engine cooling fan

2. Take away the Fan assembly from light engine.

27.4.2.2.3 Electrical disconnection of the Fans

Disconnection

1. Loosen the 4 fixation screws (A), holding Input panel to projector frame.

Image 27-44
Removal input panel

2. Keep the input panel by the provided handles and pull it backwards to remove.

   Now, the backplane (board at he bottom) is accessible on which the cable plug of the mentioned Fans are plugged in.

3. Pull the two plugs J30 & J31 out their respective socket.

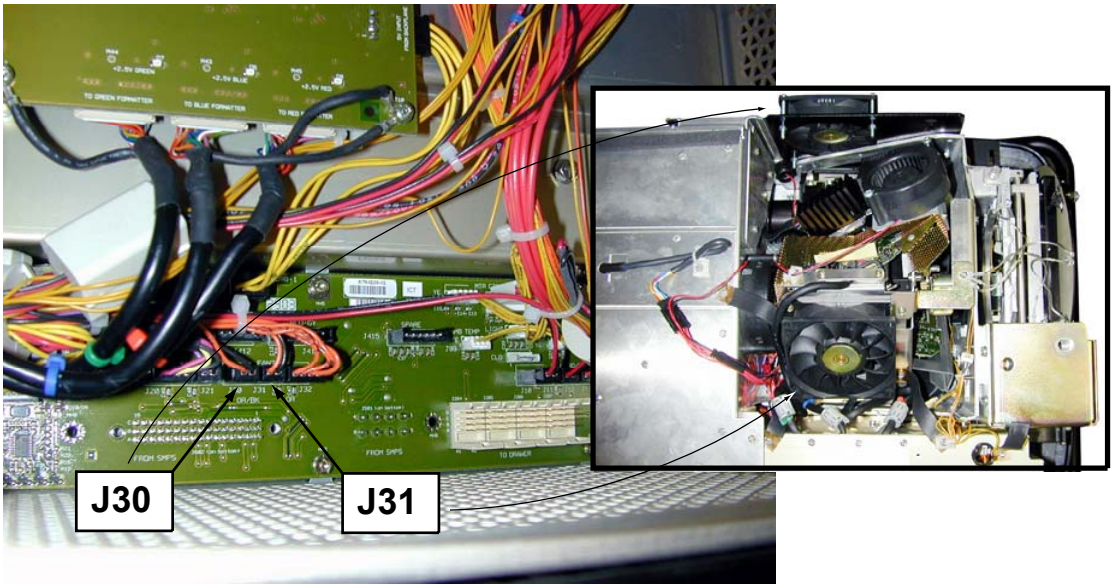


Image 27-45
Fan disconnection

   The cooling Fan for the blue DMD and the Prism are switched off.

4. Reinstall the Input panel and tighten the fixation screws.

27.4.2.3 Temporarily Replacement of the Air Channel

Overview

- Removal of the Air Channel
- Installation of the Service Air Channel (Part of the kit)

Why to replace the air channel

Between the Green DMD and the air channel there is lack of space to allow loosening the Green DMD support. Installing the service air channel, part of the kit, provides the necessary space.

27.4.2.3.1 Removal of the Air Channel

Necessary tools

- Flat blade screwdriver of 5 mm
- Torx® driver TX10
- Crosshead screwdriver (medium)

How to remove the air channel

1. Remove the ten Torx® TX10 screws (A) on top of the air channel unit.

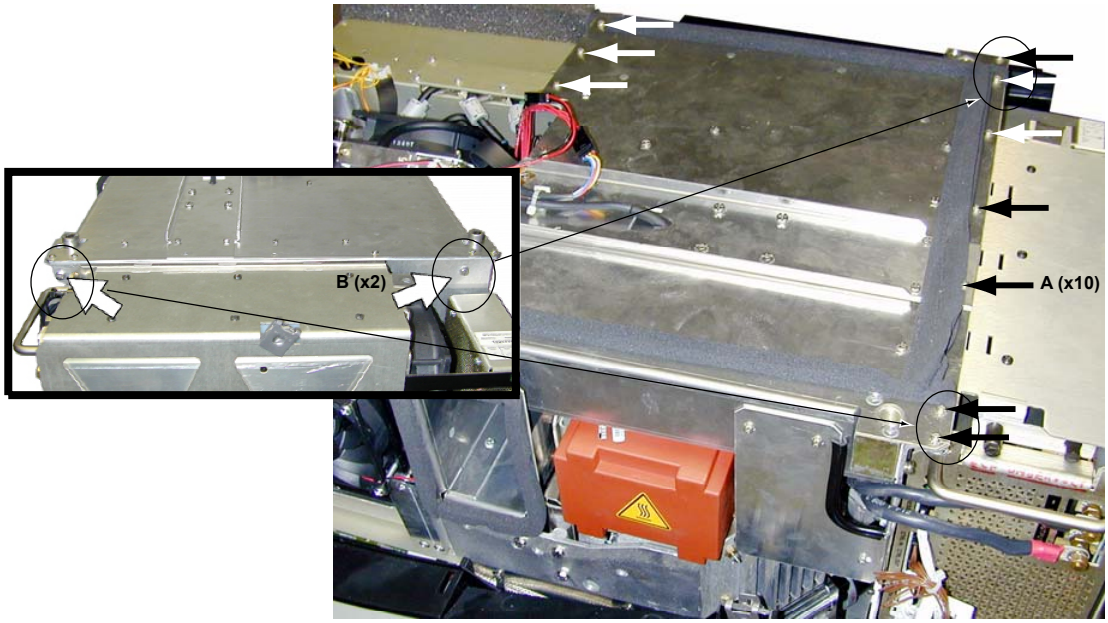


Image 27-46
Disconnection air channel

2. Remove the two bolts (B) fixating the air channel unit to the lamp power supply house (image 27-46).
3. Remove the small L shape metal support plate, fixating air channel to frame, by removing three Torx® TX10 screws.

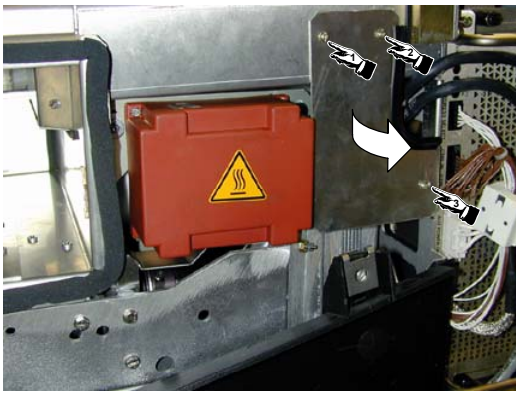


Image 27-47

4. Disconnect onto the air channel the 3 engine ground leads by removing the respective fixation screw (image 27-48).
   - (1) Ground connection top air channel
   - (2) Ground connection top air channel
   - (2) Ground connection side air channel
5. Disconnect the 2 fan cables on top of the unit by pulling the plug out its socket.
   - (3) Exhaust Fan
   - (4) Cooling Fan DMD Green

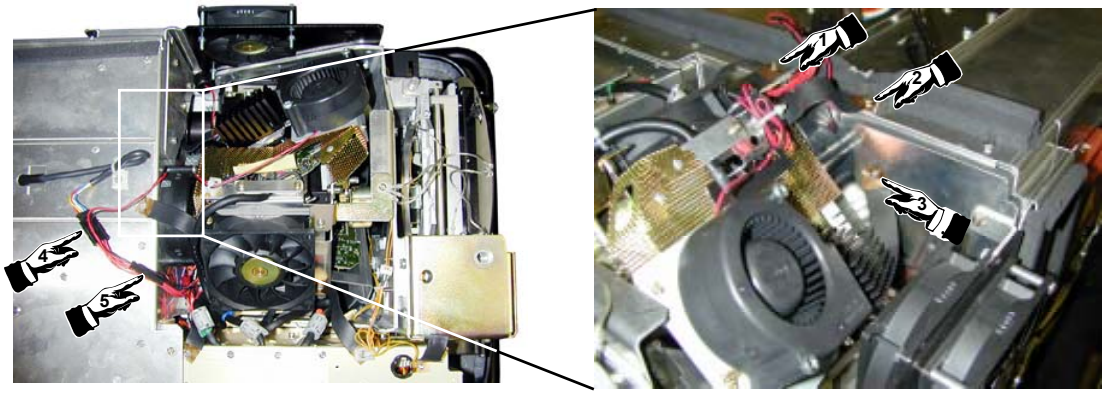


Image 27-48
Disconnection Fans and GND

6. Remove the two Torx® screws (1&2) fixating air channel unit to starter unit and remove the bolt (3) fixating air channel unit to the optical base.

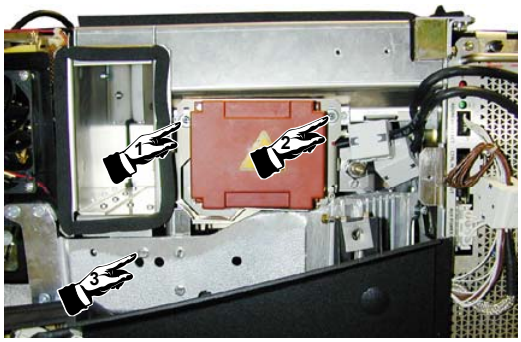


Image 27-49
Disconnection air channel

7. Remove the air channel unit by gently lifting it up.

27.4.2.3.2 Installation of the Service Air Channel (Part of the kit)

Necessary tools

No tools.

How to install the service air channel unit

1. Place the service air channel, part of the kit, on its place in the projector without fixating it.

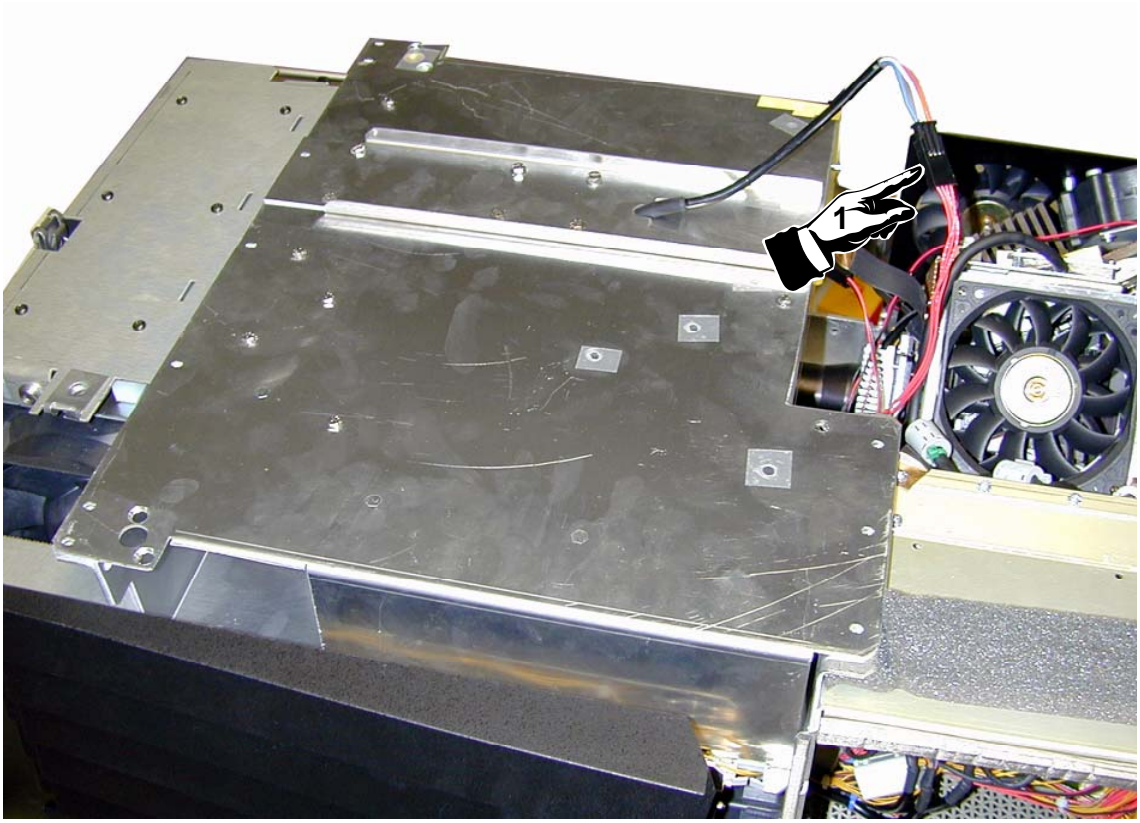


Image 27-50
Installation service air channel

2. Reconnect (1) the air channel Fan (image 27-50).

27.4.3 Re-convergence the Light Engine

27.4.3.1 Action of the convergence controls

Influence of the controls on the convergences

The DMD assemblies are provided with 3 adjustable screws. The assembly itself is kept in place by a plunger near the adjustable screw. These plungers may not be re-adjusted (indicated in the drawing with the prohibition sign).

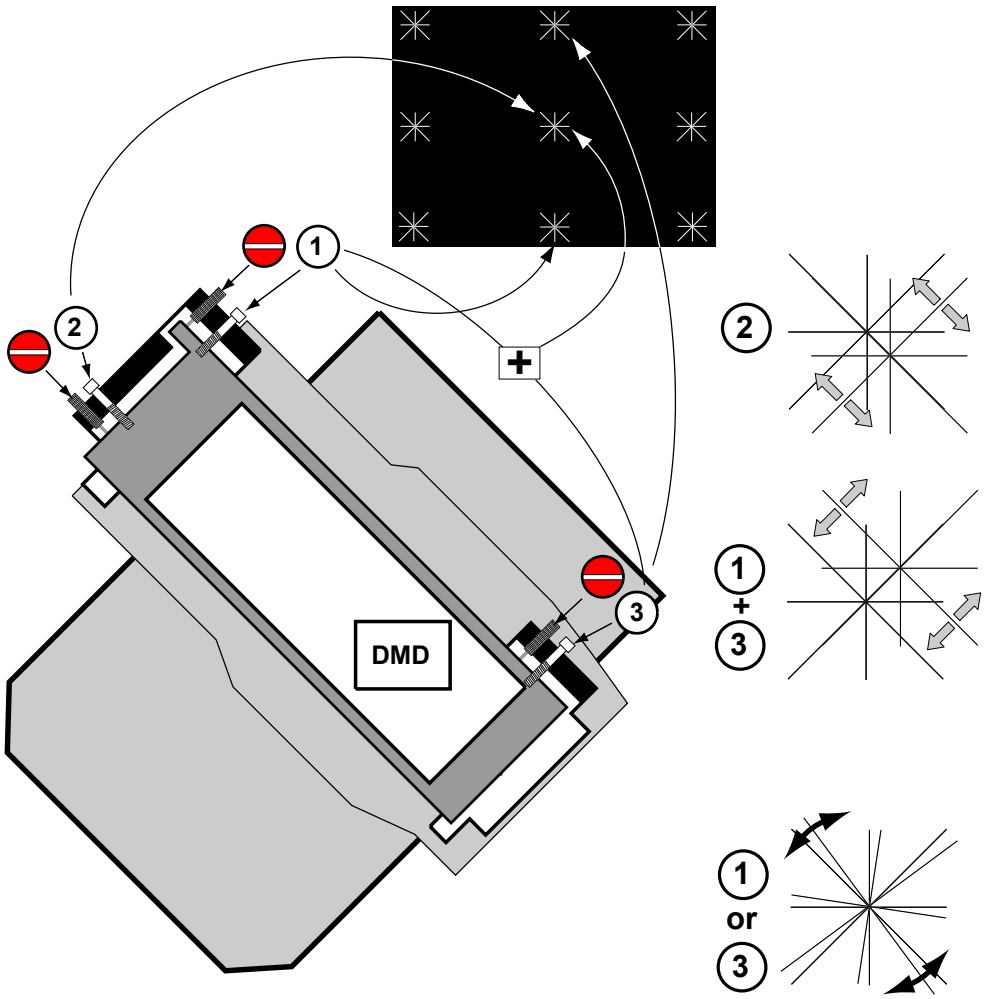


Image 27-51
Influence of the controls on the convergences

Adjusting the control(s):

- (2): Move the respective convergence pattern up or downwards 45° diagonally (Top-Left/Bottom-Right).
- (1) & (2) simultaneously: Move the respective convergence pattern up or downwards -45° diagonally (Top-Right/Bottom-Left).
- (1) or (3) separately: rotate the convergence pattern respectively +X° or -X°.

27.4.3.2 Re-convergence GREEN on RED

27.4.3.2.1 Location of controls

Location of the lock-down screws

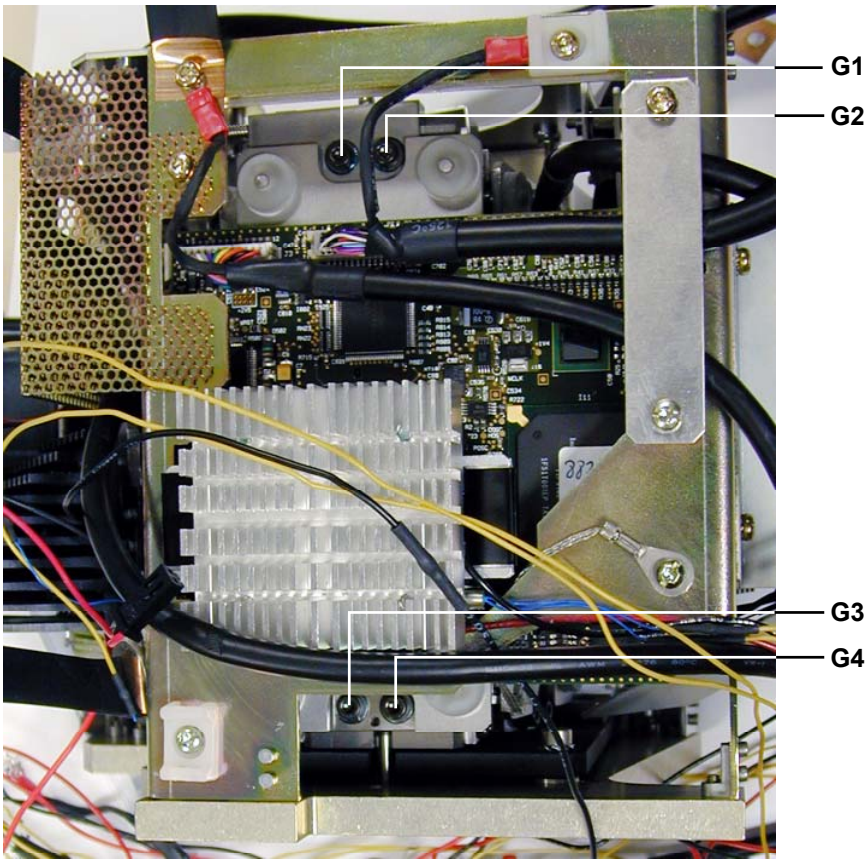


Image 27-52
Location of the lock-down screws for the green DMD assembly

Location of the convergence adjustable screws

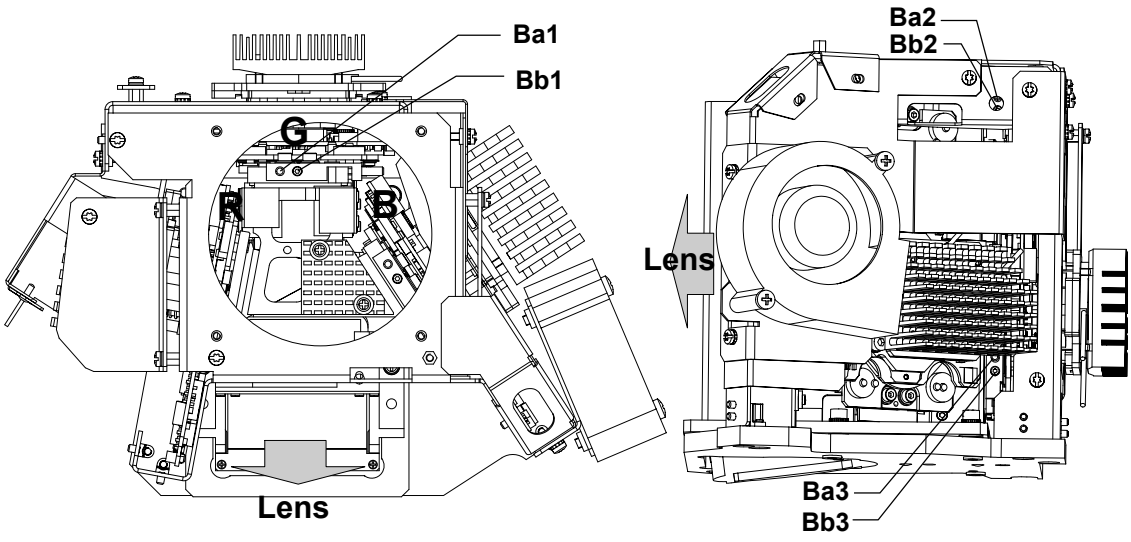


Image 27-53
Location of the convergence adjustable screws

27.4.3.2.2 Re-converging Green DMD

CAUTION: Be cautious when adjusting the convergence controls, because a small turn causes already many pixel shift.

Needed tools

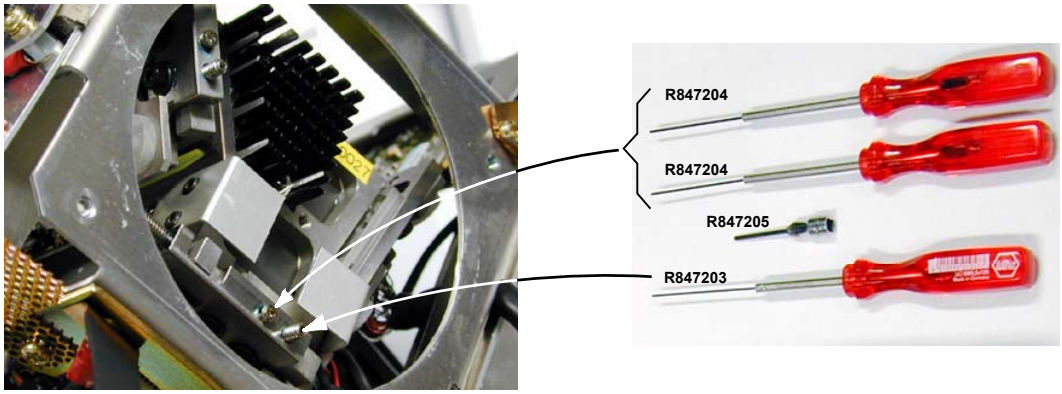


Image 27-54
Needed tools for r-convergence

For older versions of the light engine, the screwdriver R847204 is used as well for the convergence adjustable screws as well for the plungers.

How to re-convergence

1. Put the square drive socket (A), with soldered hexagon key, onto a ratchet (B).

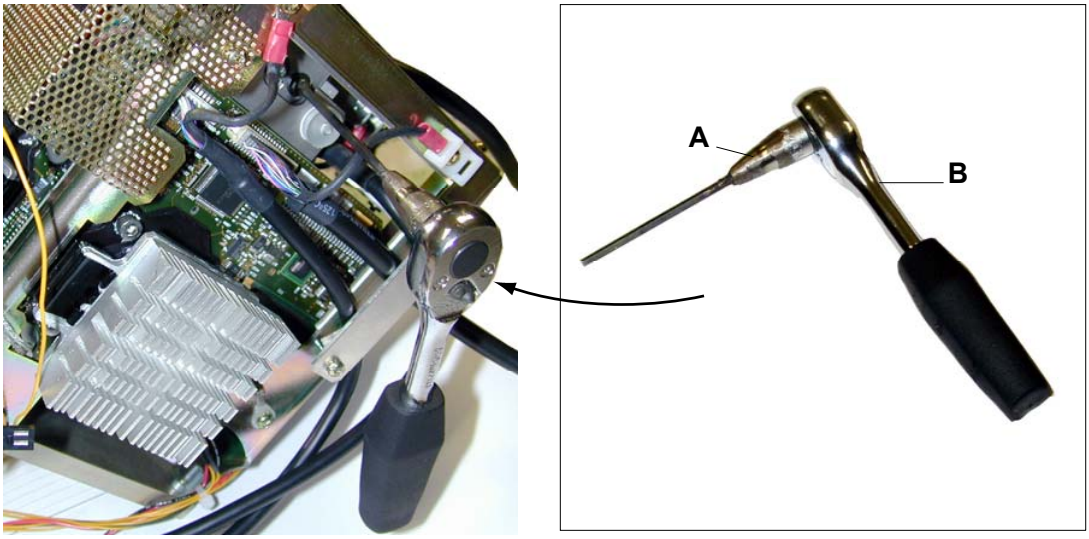


Image 27-55
Ratchet

2. Carefully release the 4 lock-down screws, holding the DMD unit onto Prism frame (image 27-52).
   Tip: *Release the lock-down screws in a way the DMD assembly becomes just movable. Keep in mind that at the end of the re-convergence, tightening the DMD unit can cause some small convergence drift.*
3. Start the re-convergence in the center of the image as follows (using tool R847204):
   - Adjust the control Gb1 until the crossing of the center Green convergence pattern coincide with the Top left/Bottom right diagonal line of the center Red convergence pattern.
   - Adjust the control Gb2 & Gb3 simultaneously until the crossing of the center Green convergence pattern coincide with the Top right/Bottom left diagonal line of the center Red convergence pattern.

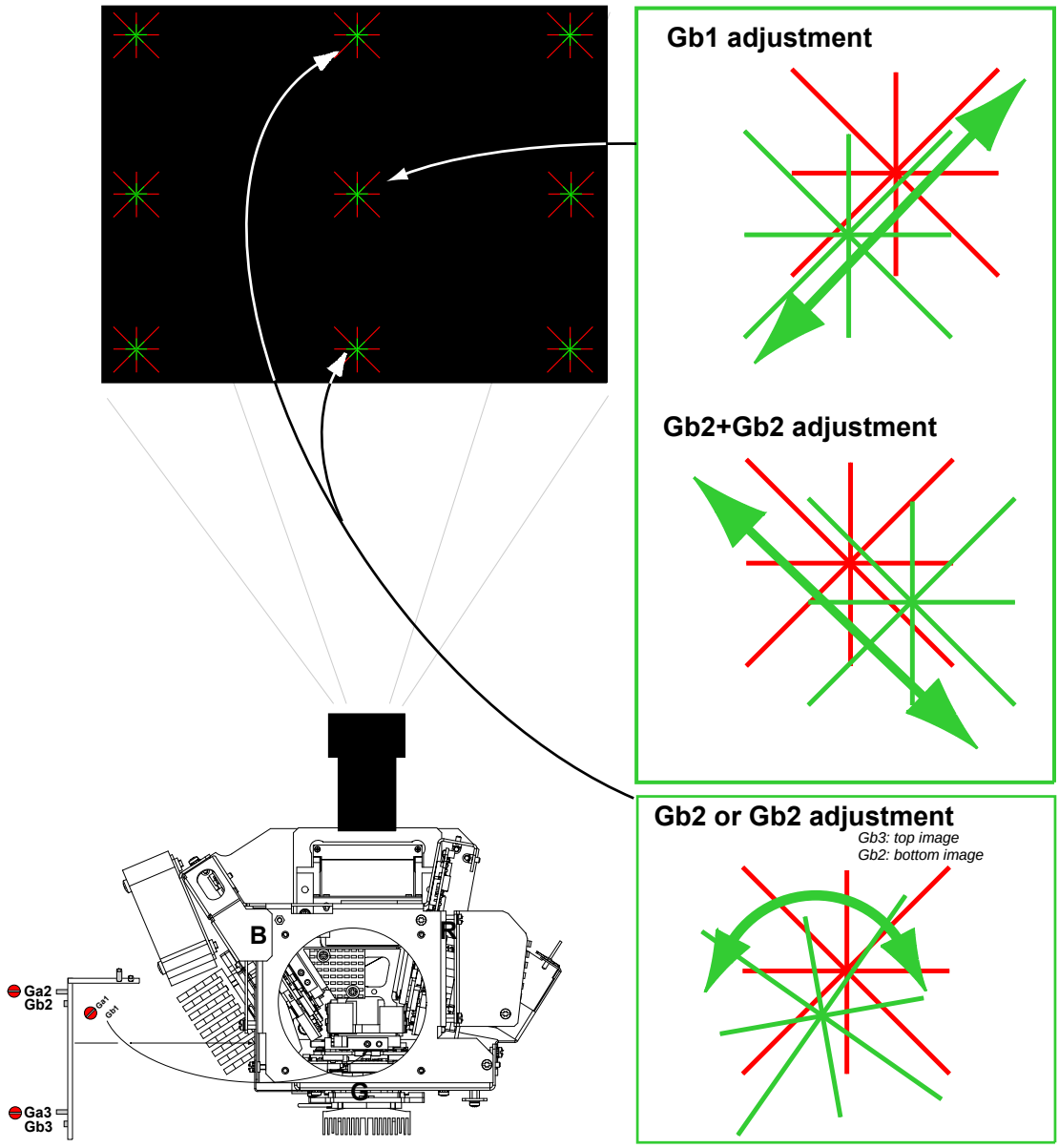


Image 27-56
Green convergence adjustment

4. Continue with re-convergence in center at the Top and the Bottom of the image as follows (using tool R847204):
   - Adjust the control Gb3 for coincidence of the diagonal Green line of the Green convergence pattern with the Red line of the Red convergence pattern in the center at the top of the image.
   - Adjust the control Gb2 for coincidence of the diagonal Green line of the Green convergence pattern with the Red line of the Red convergence pattern in the center at the bottom of the image
5. Because the different adjustments interact, step 3 and 4 have to be repeated until full coincidence of both convergence pattern is obtained.
6. Carefully secure the position of the DMD assembly by tightening the 4 lock-down screws.

27.4.3.2.3 Readjustment of the plungers

CAUTION: Do NOT adjust the plungers on the DMD assembly, if small convergence drifts have to be corrected only.

For extreme convergence adjustments, possible in case after the replacement of a DMD assembly, a readjustment of the plungers can be necessary.

Convergence screw is end of course

1. Turn the plunger (A) a few turns counterclockwise.

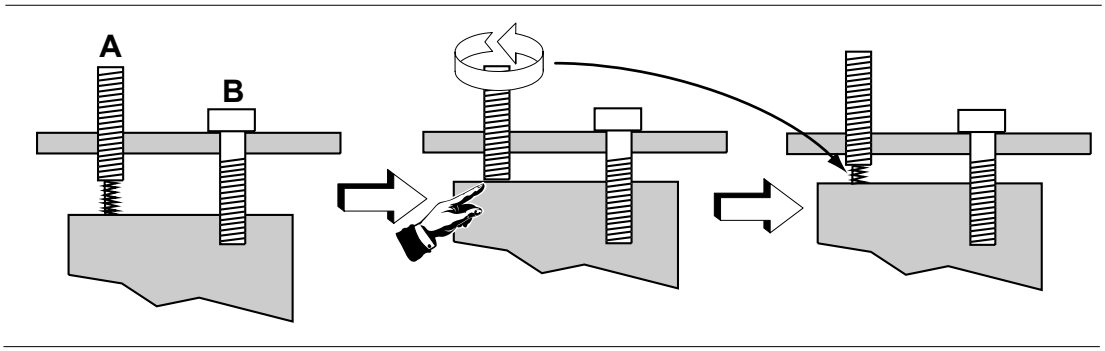


Image 27-57
Readjustment plunger

2. Continue with the fine convergence adjustment

Convergence screw sense no resistance

1. Turn the plunger clockwise until resistance is sensed again.

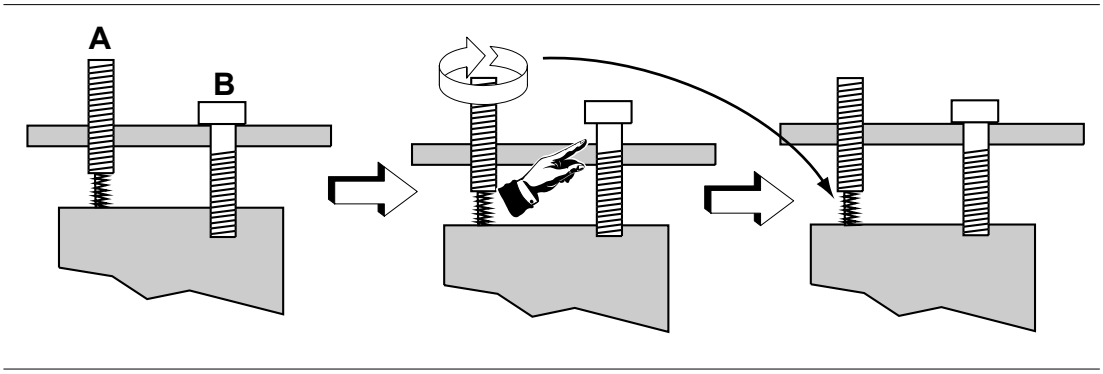


Image 27-58
Readjustment plunger

2. Continue with the fine convergence adjustment

27.4.3.3 Re-convergence BLUE on RED

27.4.3.3.1 Location of controls

Location of the lock-down screws

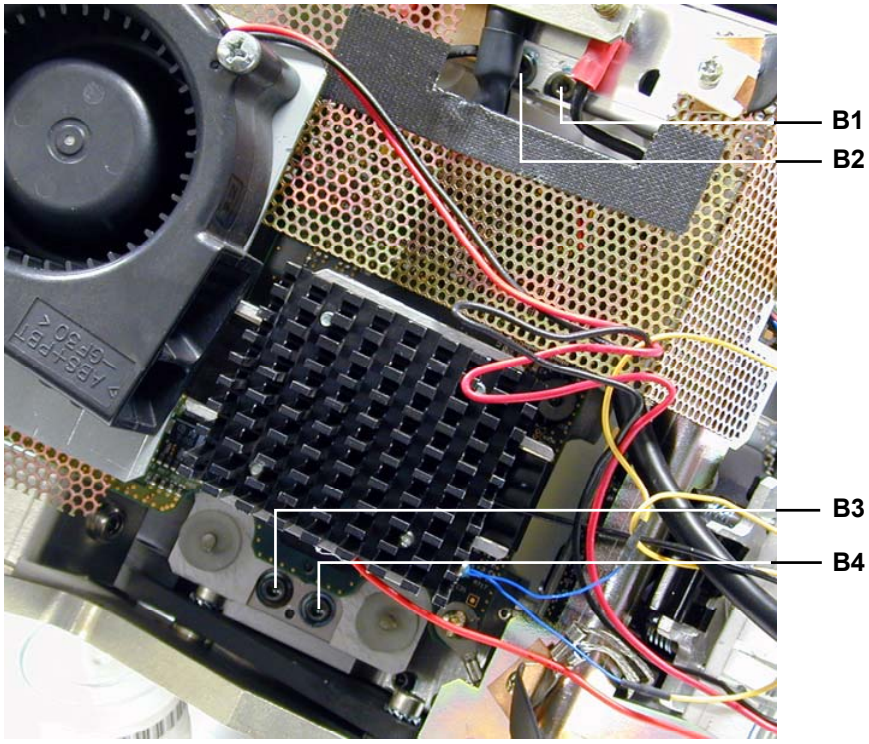


Image 27-59
Location of the lock-down screws for the blue DMD assembly

Location of the convergence adjustable screws

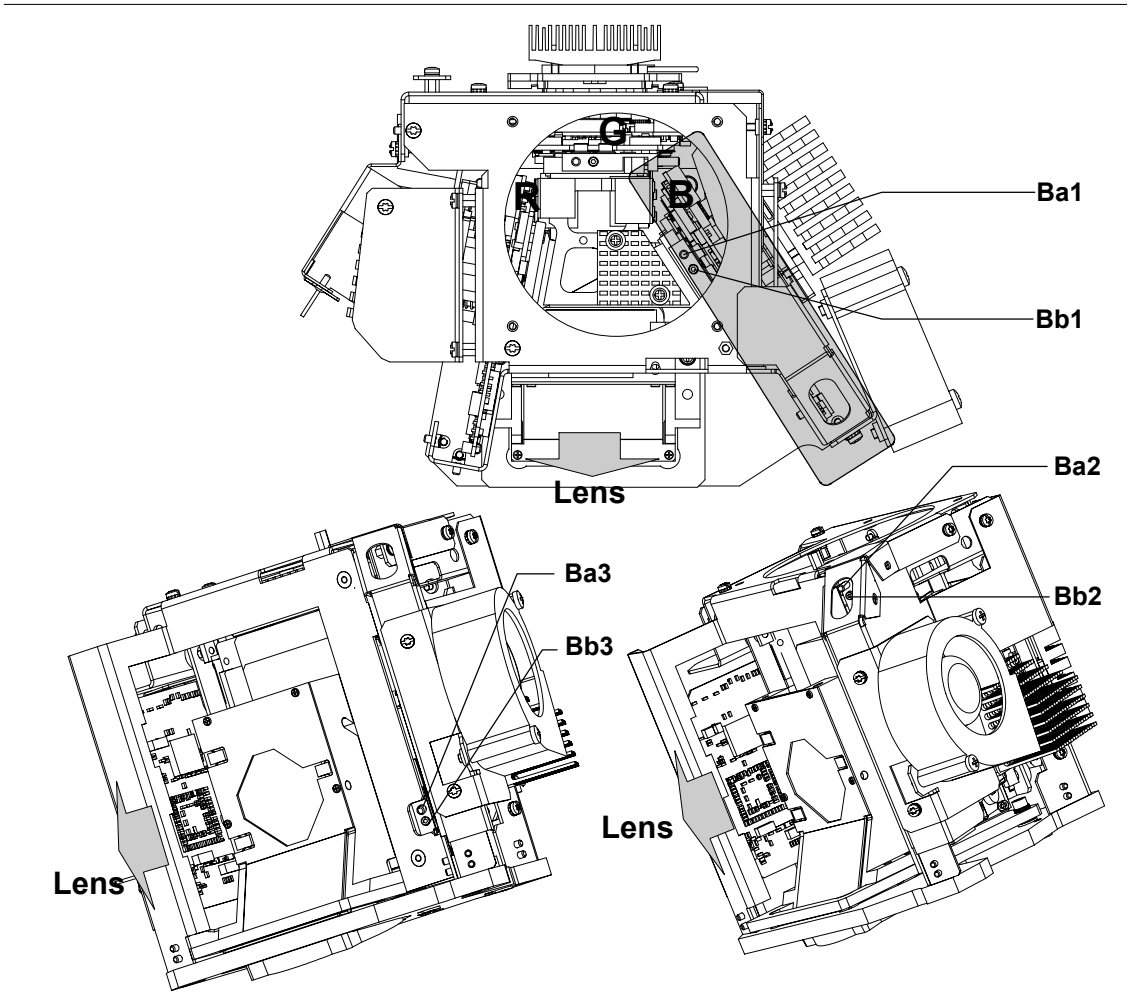


Image 27-60
Location of the convergence adjustable screws

27.4.3.3.2 Re-converging Blue DMD

CAUTION: Be cautious when adjusting the convergence controls, because a small turn causes already many pixel shift.

Needed tools

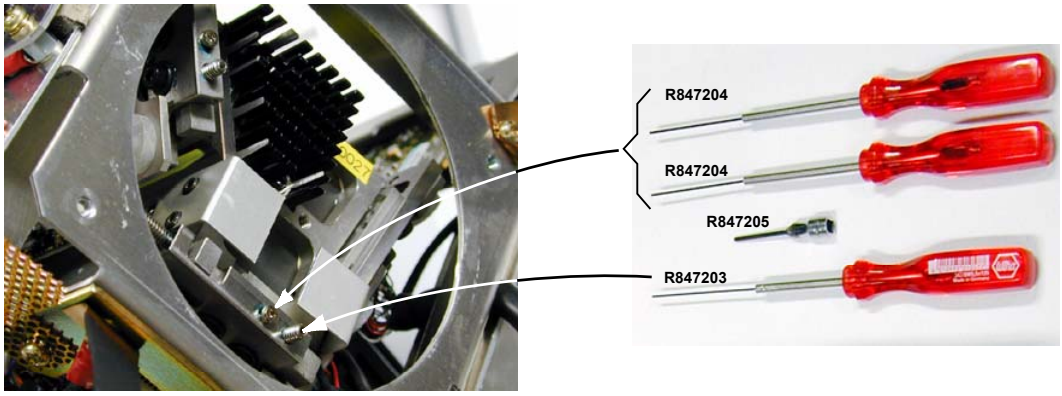


Image 27-61

For older versions of the light engine, the screwdriver R847204 is used as well for the convergence adjustable screws as well for the plungers.

How to re-convergence

1. Put the square drive socket (A), with soldered hexagon key, onto a ratchet (B).

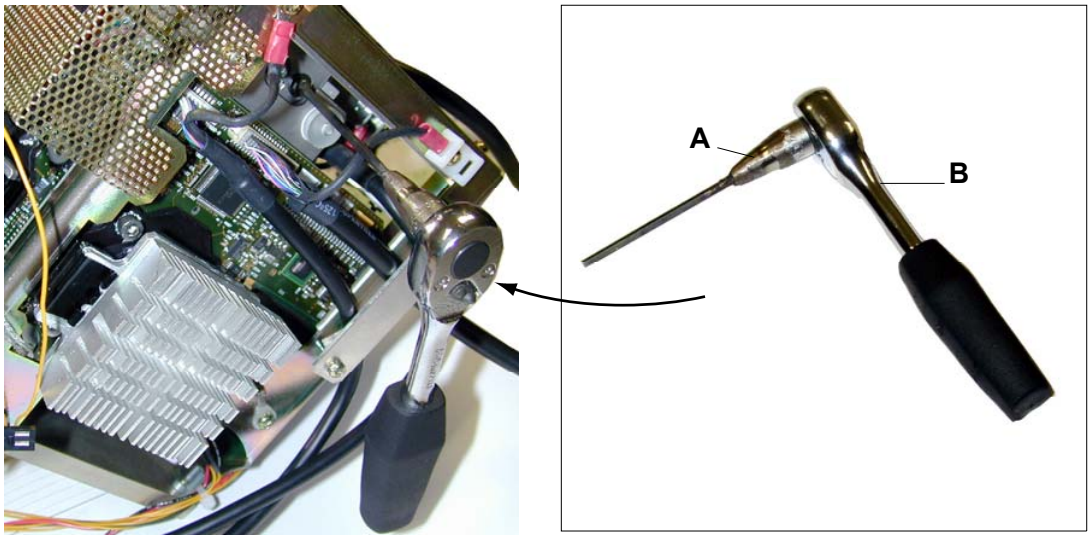


Image 27-62

2. Carefully release the 4 lock-down screws, holding the DMD unit onto Prism frame (image 27-59).
   Tip: *Release the lock-down screws in a way the DMD assembly becomes just movable. Keep in mind that at the end of the re-convergence, tightening the DMD unit can cause some small convergence drift.*
3. Start the re-convergence in the center of the image as follows (using tool R847204):
   - Adjust the control Bb1 until the crossing of the center Blue convergence pattern coincide with the Top left/Bottom right diagonal line of the center Red convergence pattern.
   - Adjust the control Bb2 & Bb3 simultaneously until the crossing of the center Blue convergence pattern coincide with the Top right/Bottom left diagonal line of the center Red convergence pattern.

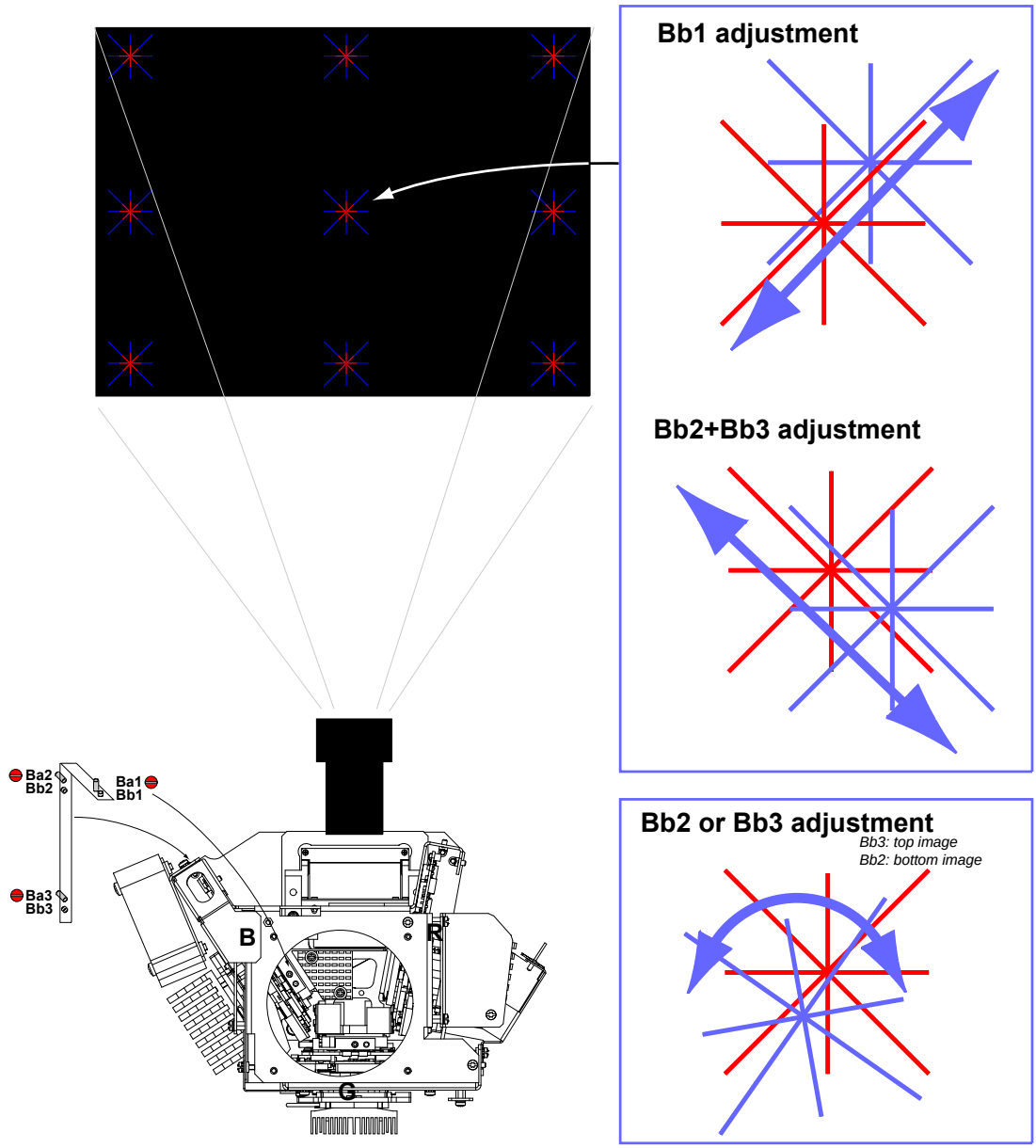


Image 27-63
Blue convergence adjustment

4. Continue with re-converging the center at the Top and the Bottom of the image as follows (using tool R847204):
   - Adjust the control Bb3 for coincidence of the diagonal Blue line of the Blue convergence pattern with the Red line of the Red convergence pattern in the center at the top of the image.
   - Adjust the control Bb2 for coincidence of the diagonal Blue line of the Blue convergence pattern with the Red line of the Red convergence pattern in the center at the bottom of the image
5. Because the different adjustments interact, step 3 and 4 have to be repeated until full coincidence of both convergence pattern is obtained.
6. Carefully secure the position of the DMD assembly by tightening the 4 lock-down screws.

27.4.3.3.3 Readjustment of the plungers

CAUTION: Do NOT adjust the plungers on the DMD assembly, if small convergence drifts have to be corrected only.

For extreme convergence adjustments, possible in case after the replacement of a DMD assembly, a readjustment of the plungers can be necessary.

Convergence screw is end of course

1. Convergence screw is end of course

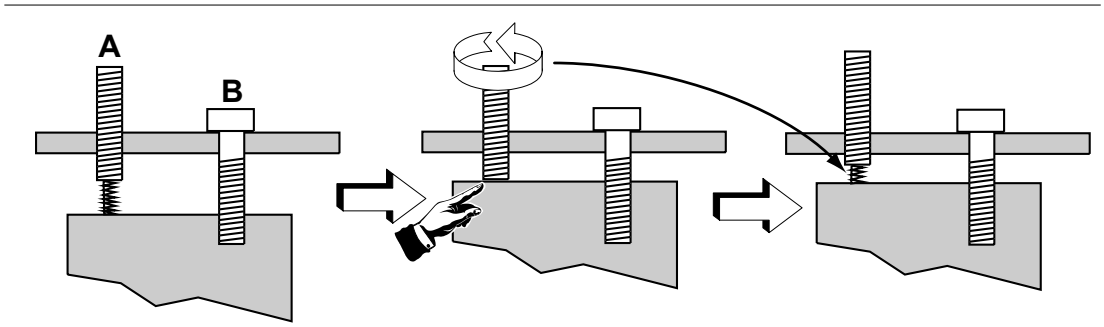


Image 27-64
Readjustment plunger

2. Continue with the fine convergence adjustment

Convergence screw sense no resistance

1. Turn the plunger clockwise until resistance is sensed again.

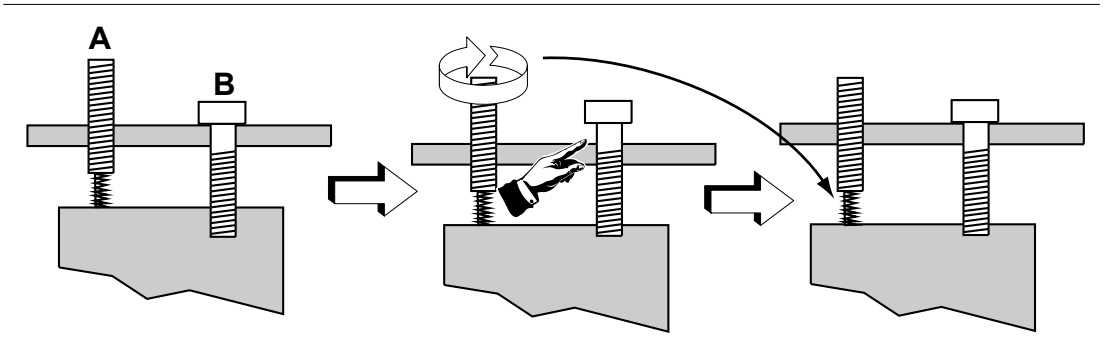


Image 27-65
Readjustment plunger

2. Continue with the fine convergence adjustment

27.5 Engine Replacement

27.5.1 Safety Instructions

27.5.1.1 General

Who may perform the installation ?

This installation must be performed by authorized technical personnel only.

Authorized technical personnel : persons having appropriate technical training and experience necessary to be aware of hazards to which they are exposed in performing a task and of measures to minimize the danger to themselves or other persons.

Cautions

Before attempting to remove any to the projector's covers, the projector has to be turned off and disconnected from the wall outlet to minimize the risk of electric shock.

Before starting with the Replacement of the Engine, always let cool down the projector after operation in order to reduce the heat on parts in the light path and to avoid burns.

Eye warning

Eye damage may result from direct viewing the light produced by the lamp used in this equipment. Always turn off the lamp before opening cover.

Product care

Installation kit. The kit R840527K is designed for use ONLY with the Barco SLM 12+ and 9+ series projectors.

Replacement parts. When replacement parts are required, be sure the service technician has used original Barco replacement parts or authorized replacement parts which have the same characteristics as the Barco original part. Unauthorized substitutions may result in degraded performance and reliability, fire, electric shock or other hazards. Unauthorized substitutions may void warranty.

Under no circumstances are Barco parts repairable by anyone other than Barco.

Electrostatic protection

The projector uses components which can be damaged by static charges. Most semiconductors can suffer serious degradation as a result of static charges, ever though complete failure may not occur. All necessary precautions when handling static-sensitive devices should be observed.

27.5.2 Access to Image Processor Unit

27.5.2.1 Removal of the Input Assembly

How to remove

1. See "Removing the Input Assembly", page 200

27.5.2.2 Removing the side panel

Necessary tools

A flatblade screwdriver of 5 mm

How to remove

1. Turn with a screwdriver the side panel lock screw a quarter turn counter clockwise.

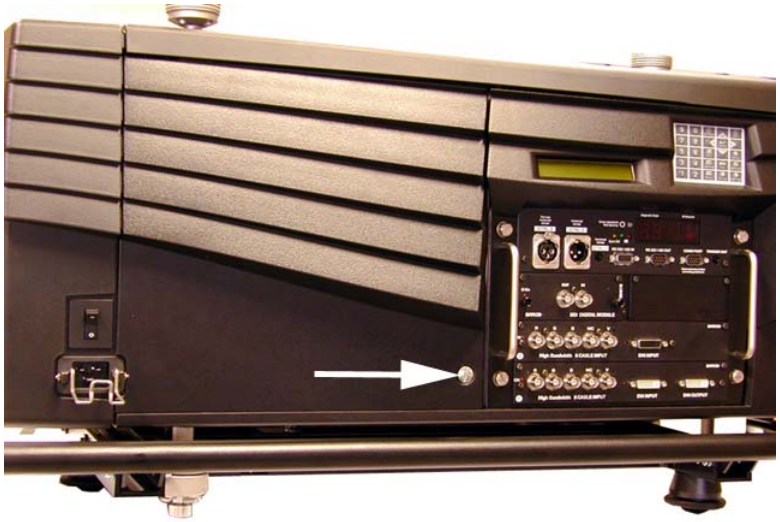


Image 27-66
Unlocking the side cover

2. Pull the right side of the panel towards you and further to the right to remove.

Image 27-67
Pull and remove the side cover

27.5.2.3 Removal of the Back Cover

How to remove

1. See "Removing the Back Cover", page 200

27.5.2.4 Removing the Lens

When to perform this procedure?

The lens needs to be removed when removing the covers from the projector.

How to remove the Lens?

1. Support the lens with one hand.
2. Move the Lens Handle (A) to the right to unlock the lens.

Image 27-68
Lens installation

3. Slide out the lens, this will disconnect the Lens Block Connector (B).

27.5.2.5 Removal of the Top Cover

How to remove

1. See "Removing the top cover", page 201

27.5.2.6 Removal of the lamp unit

How to remove

1. See "Removing the Lamp Unit.", page 193

27.5.2.7 Removing the SM Power Supply Module

What has to be done ?

The cover doors must be removed first. Then unplug the cables and module can be removed completely.

Necessary tools

Flatblade screwdriver of 5mm

Access to the SMPS

1. Turn out the screw (A) of the plastic cover door.

Image 27-69
SMPS cover door screw

2. Move the side panel downwards to remove.

Image 27-70
Remove cover door

3. Unlock the metal cover lock screw (B) by turning it half a turn counter clockwise.

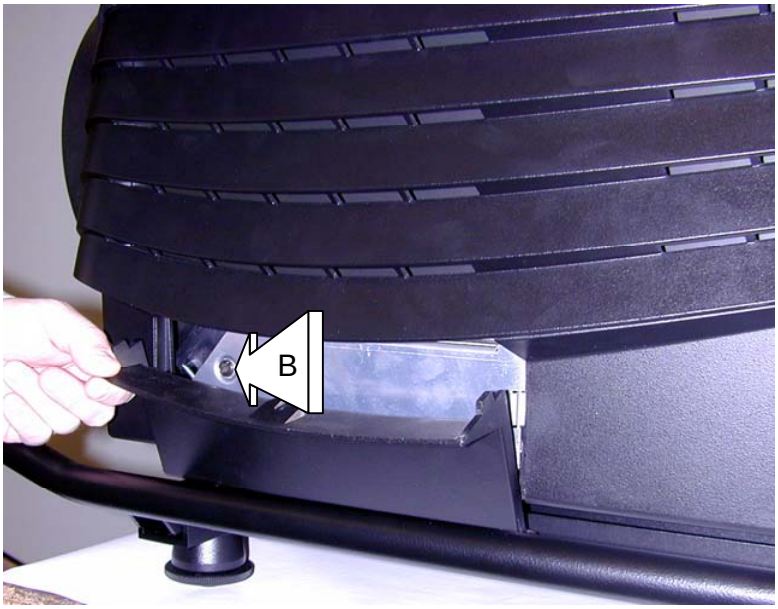


Image 27-71
Unlock lock screw

4. Turn the metal cover door to the right and remove.

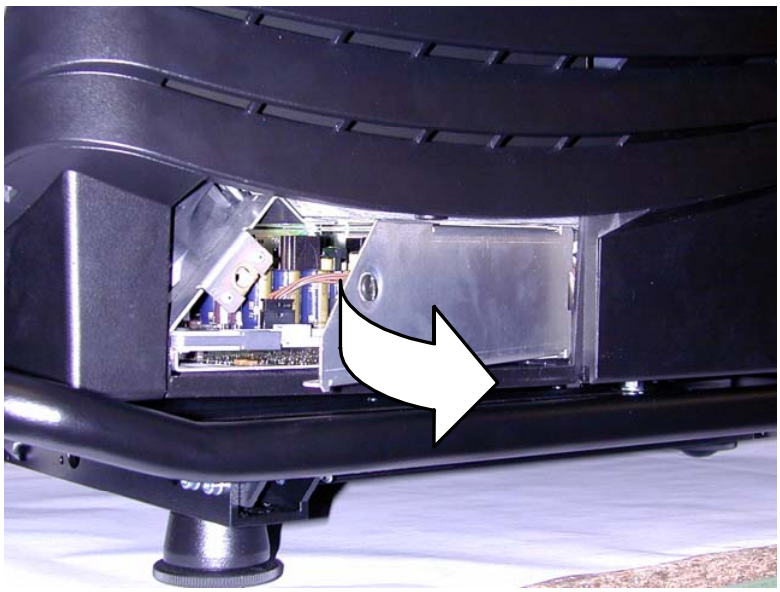


Image 27-72
Remove metal cover door

Removing the SMPS module

1. Pull the 3 plugs (A, B and C) out of their respective socket.

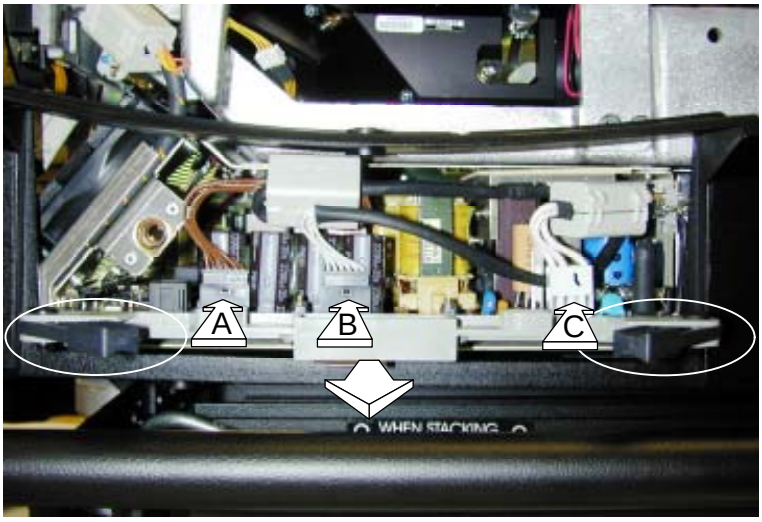


Image 27-73

2. Unlock the 2 module locks
3. Slide the module out the projector frame.

27.5.2.8 Removal of the Air Channel

How to remove

1. See "Removal of the Air Channel", page 205

27.5.3 Removing the Engine

27.5.3.1 Overview connections behind input box

Overview

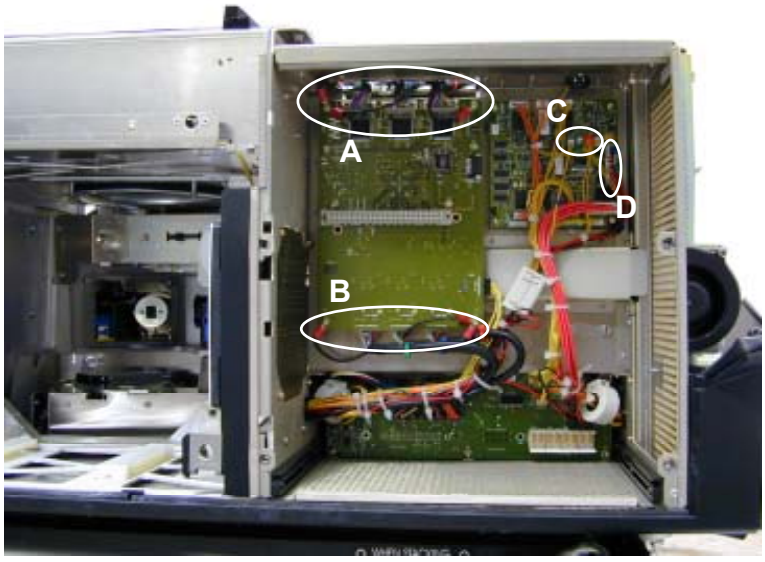


Image 27-74
Overview connections

Overview connections

1. Formatter power disconnection (A)
2. Formatter signal disconnection (B)
3. Temperature sensors (C)
4. Peltier connections (D)

27.5.3.2 Disconnecting the formatter and DMD connections

Necessary tools

- Torx® driver TX10
- Pair of wire-cutters

Disconnect the formatter power connections

1. Turn out both screws (1) fixing the ground leads of the formatter supply cables to the formatter interface board.

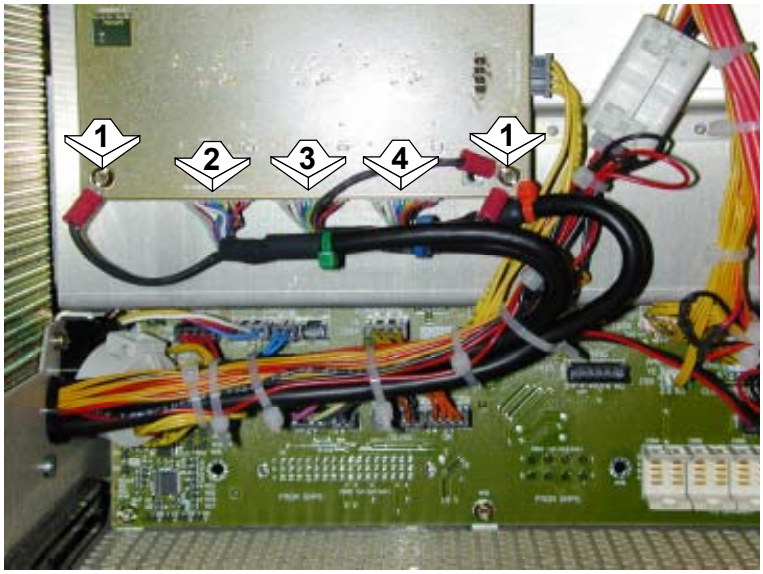


Image 27-75
Formatter supply connections

2. Pull out the formatter power connectors (2, 3 and 4).

2	green formatter power connector
3	blue formatter power connector
4	red formatter power connector

3. Cut the white wire tires.

Disconnect the formatter signal connections

1. Turn out both screws (5) fixing the ground leads of the formatter signal cables to the formatter interface board.

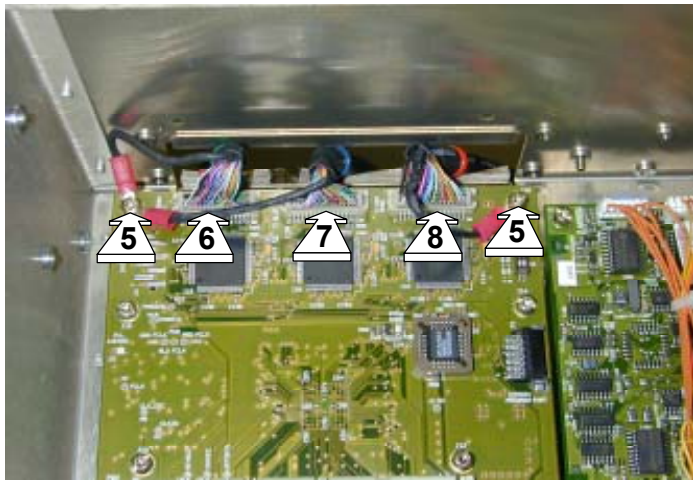


Image 27-76
Formatter signal connections

2. Pull out the formatter signal connectors (7, 8 and 9)

7 green formatter signal connector

8 blue formatter signal connector

9 red formatter signal connector

3. Pull the wires through the opening on top of the formatter board.

Temperature sensor and Peltier elements disconnection

1. Pull out the temperature connectors 1, 2 and 3.

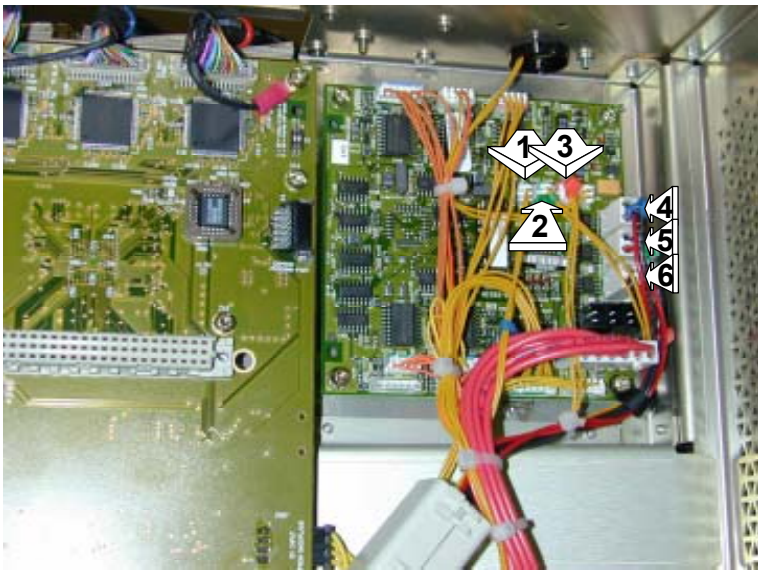


Image 27-77
Temperature and Peltier connection

1 blue temperature sensor connector

2 green temperature sensor connector

3 red temperature sensor connector

2. Pull out the Peltier elements connectors 4, 5 and 6.

4 blue Peltier element connector

5 green Peltier element connector

6 red Peltier element connector

3. Remove the core tube around the cable bundle. Left up both clips and pull the tube open.

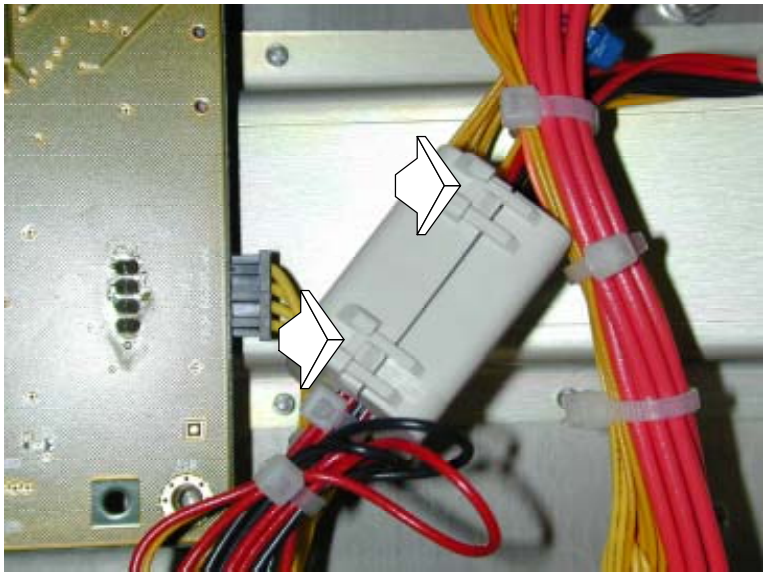


Image 27-78
Core tube removal

4. Turn out the screw holding the cable support to the right lower corner of the temperature and motor control board.

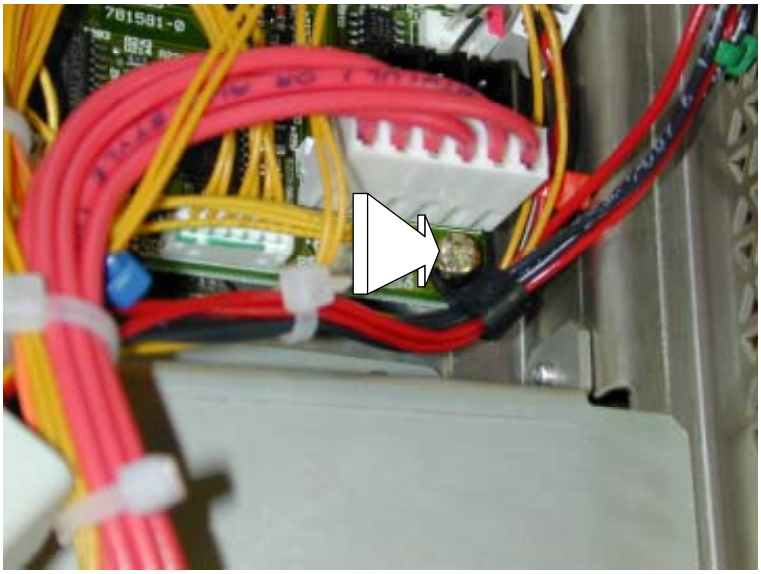


Image 27-79
Cable support removal

27.5.3.3 Removing the disconnected cables

How to remove ?

1. Push and pull cable by cable through the hole in the metal side plate. Be careful with the connectors.

Image 27-80
Cable pass through

27.5.3.4 Disconnect the lens sensor cable

How to disconnect ?

1. Disconnect the lens sensor cable through the lens holder gap.

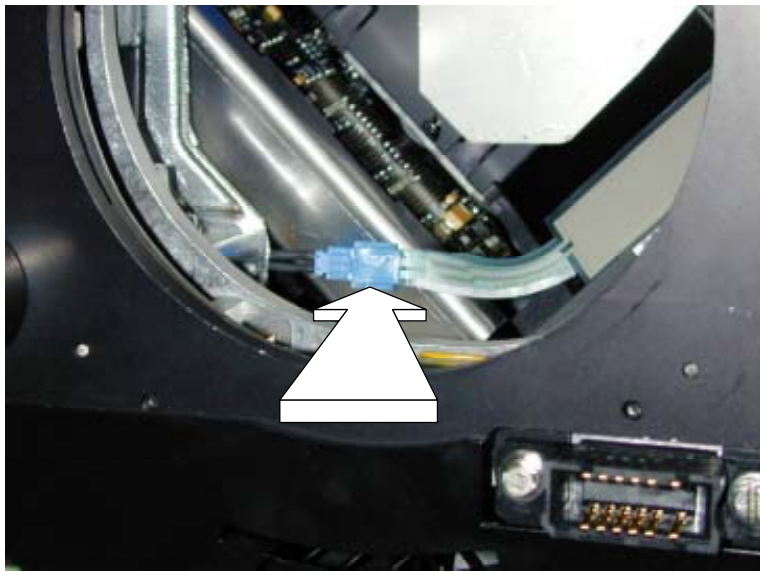


Image 27-81
Lens sensor cable disconnection

27.5.3.5 Disconnect the shutter

How to disconnect ?

1. Disconnect the shutter cable on top of the shutter.

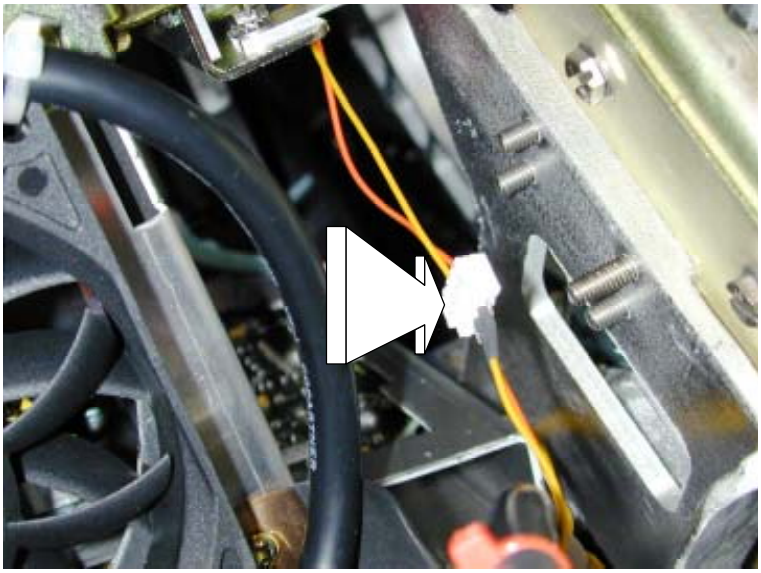


Image 27-82
Shutter cable disconnection

27.5.3.6 Disconnect the lens holder ground leads

Necessary tools

Torx® driver TX10

How to disconnect ?

1. Turn out the screw on top of the lens holder mechanism.

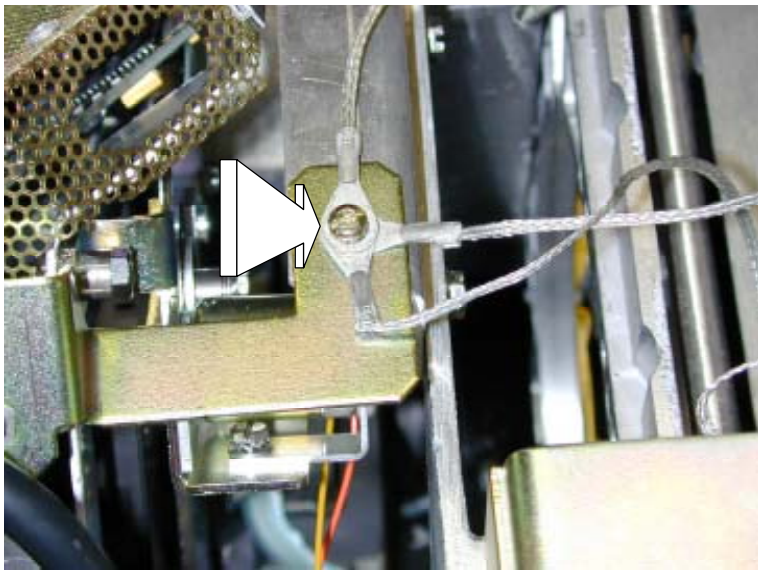


Image 27-83
Lens holder ground leads disconnection

The 3 ground leads are now free.

27.5.3.7 Disconnecting the engine fans

How to disconnect the red DMD fan ?

1. Cut the white wire tire.

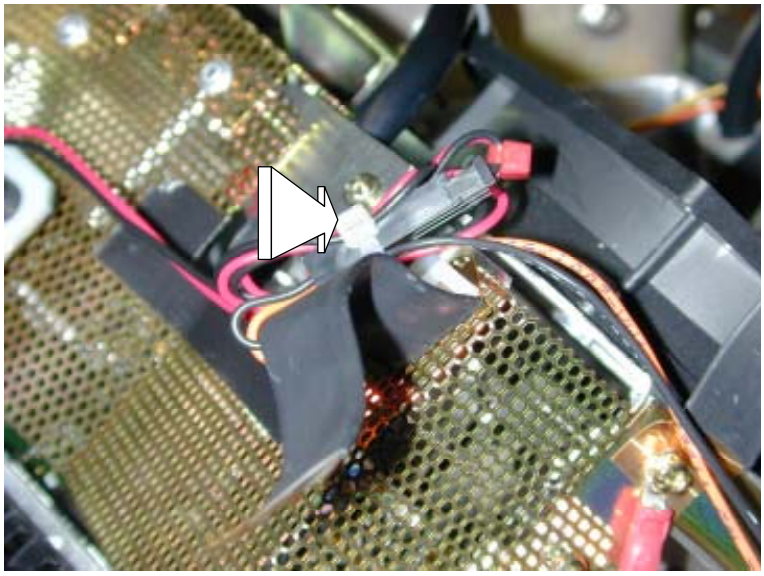


Image 27-84
Red DMD fan dicsonnection

2. Unplug the black connector.

   The supply wires are black and orange.

How to disconnect the prism fan ?

1. Cut the white wire tire.

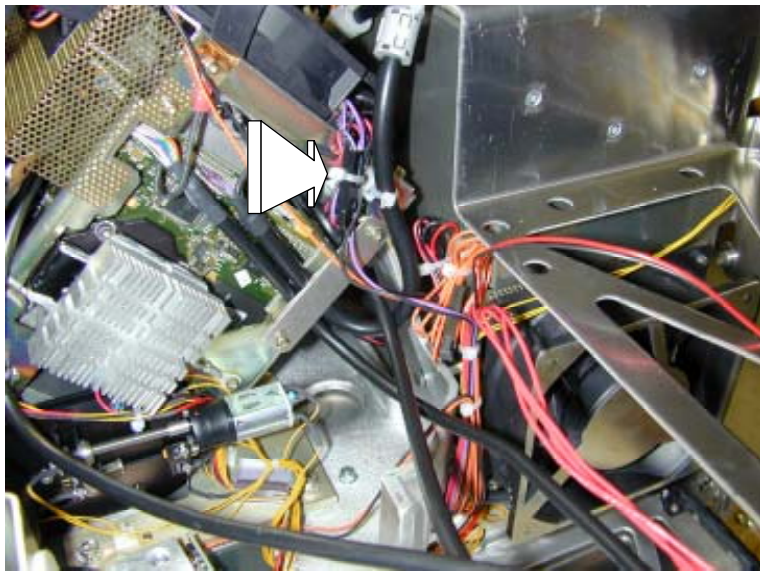


Image 27-85
Prism fan disconnection

2. Disconnect the black connector.

   The supply wires are black and purple.

27.5.3.8 Removing the engine

Necessary tools

Hex ball head screwdriver 3mm

How to remove ?

1. Turn out both bolts, fixing the engine to the optical base.

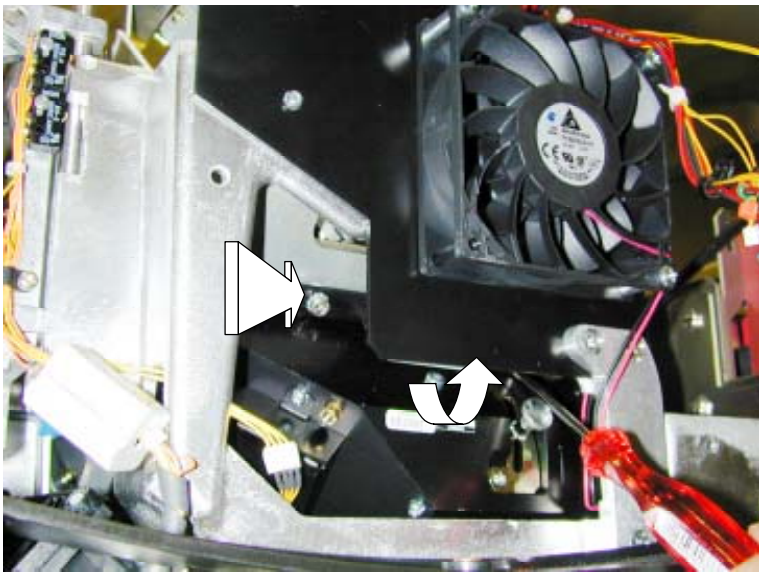


Image 27-86
Upper fixation bolts engine

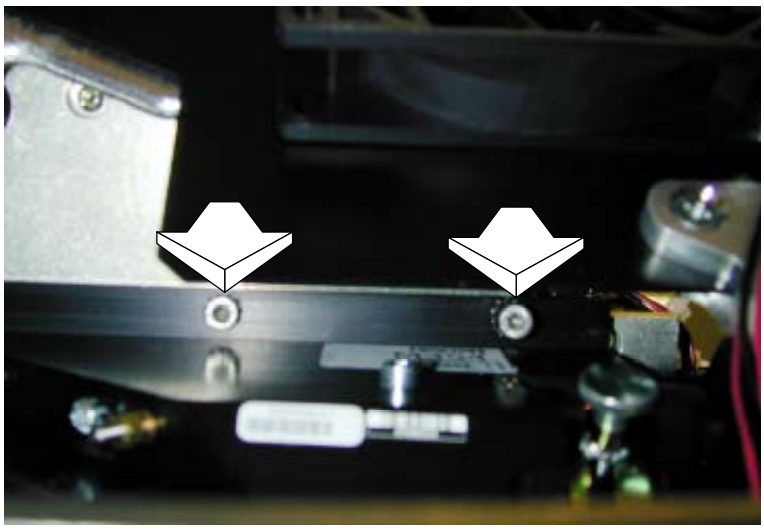


Image 27-87
Upper fixation bolts engine, bottom view

2. Turn out the lower fixation bolt through the hole in the upper side of the SMPS cabinet. The bolt is mounted under approximately 45 degrees.

Image 27-88
Lower fixation bolt engine

3. Lift out the engine.

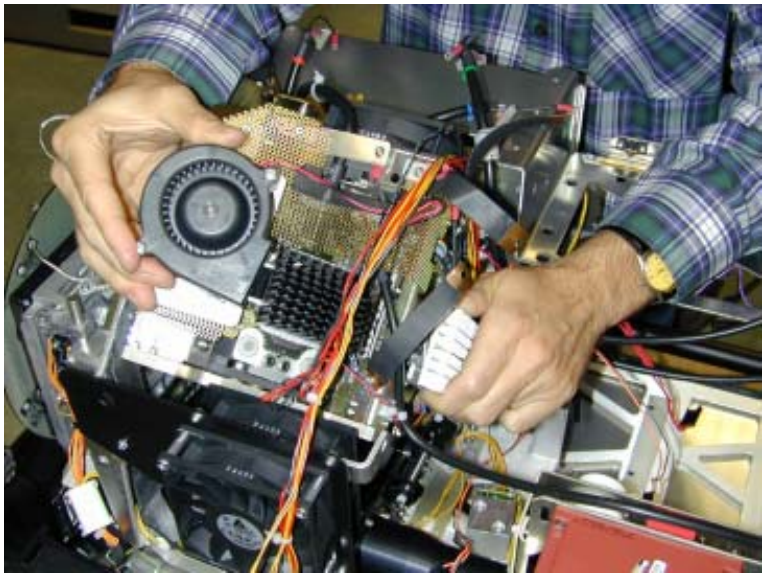


Image 27-89
Lifting up the engine

27.5.4 Installing a new engine

27.5.4.1 Mounting the engine

Necessary tools

Hex ball head screwdriver 3mm

How to mount ?

1. Carefully inset the engine into the projector in such a way that the pins (A) on the optical base matches the center holes (B) in the positioning plate of the engine.
   Note: *Be careful with the cables. Ensure that those cables are not blocked between the mechanical parts.*

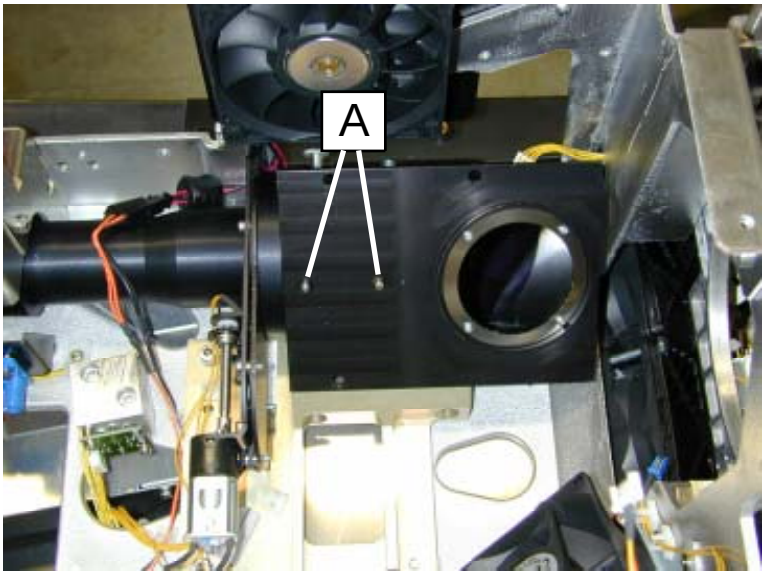


Image 27-90
Positioning pins on optical base

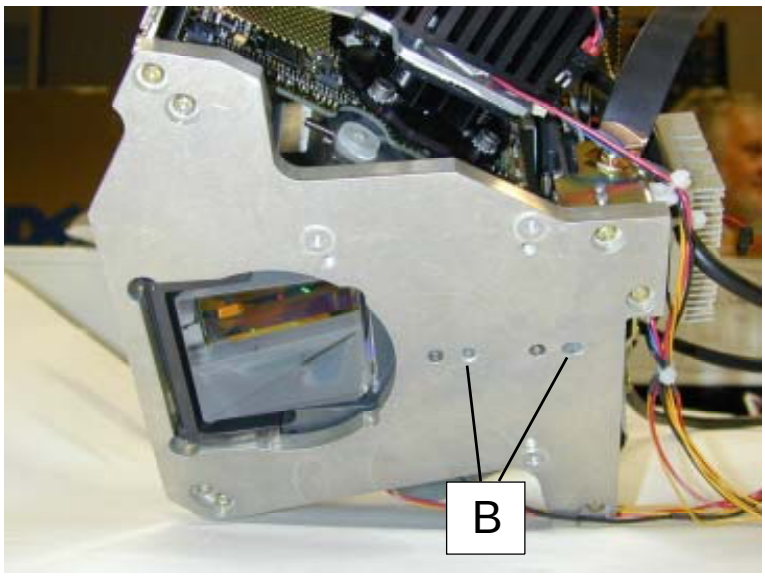


Image 27-91
Positioning holes on engine

2. Turn in both upper fixation bolts.

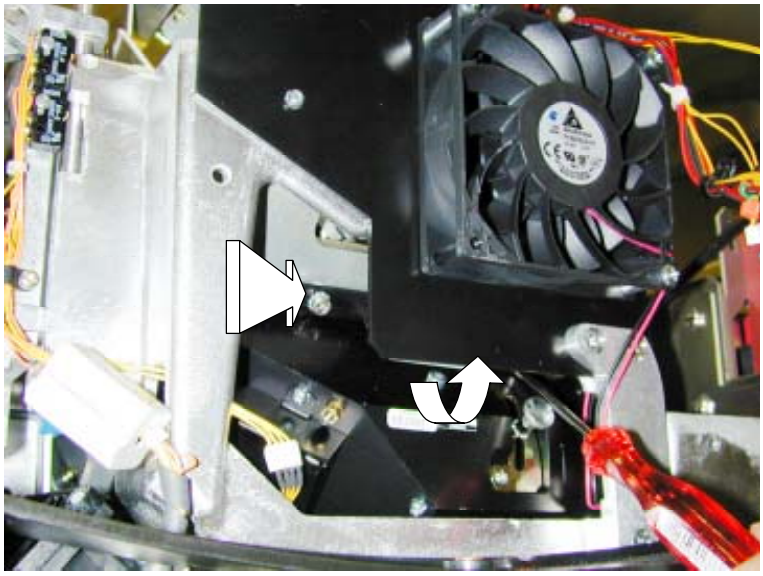


Image 27-92
Upper fixation bolts

3. Insert the lower fixation bolt through the gap in the upper plate of the SMPS cabinet.

Image 27-93

27.5.4.2 Guiding the cables

How to guide the wires ?

1. Push the small colored wires for temperature sensing and Peltier cooling through the gap.

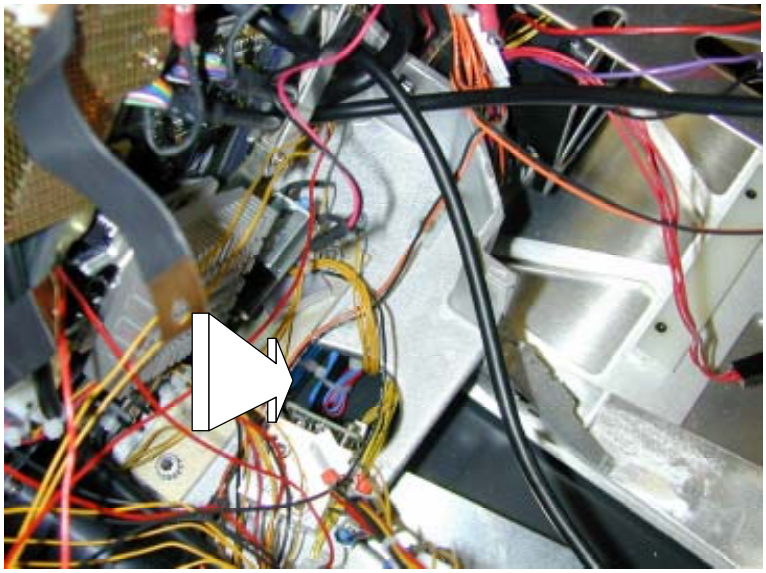


Image 27-94
Cable gap in optical base

2. Push the long black wires (power supply wires) of engine through the same gap.
3. Pull the wires through gap A and push them one for one through the pass-through (B) in the side plate of the input panel.

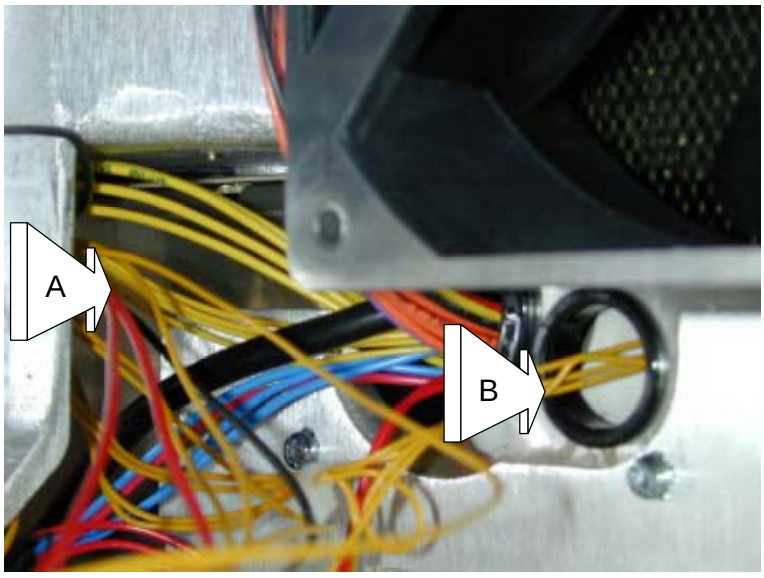


Image 27-95

27.5.4.3 Connecting the engine fans

Necessary tools

Torx® driver TX10

Engine signal connection

1. Push the short black cables through the gap between the formatter interface board and metal plate.
2. Plug in the connectors in the respective sockets. The cables are labelled with a colored wire tire.

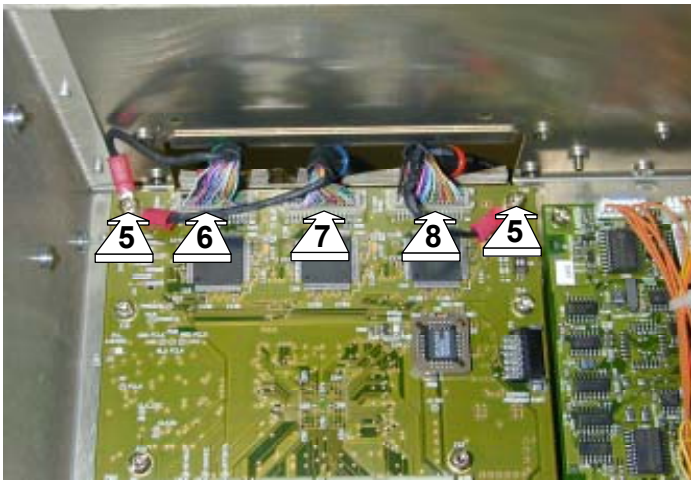


Image 27-96
Formatter signal connection

6 green formatter signal connector

7 blue formatter signal connector

8 red formatter signal connector

3. Take the eyes of the green and the blue ground lead together, insert a Torx® screw and fixate it to the left fixation hole (left 5).
4. Take the eye of the red ground lead, insert a Torx® screw and fixate to the right fixation hole (right 5)

Temperature and Peltier connection

1. Plug in the temperature sensor connectors 1, 2 and 3.

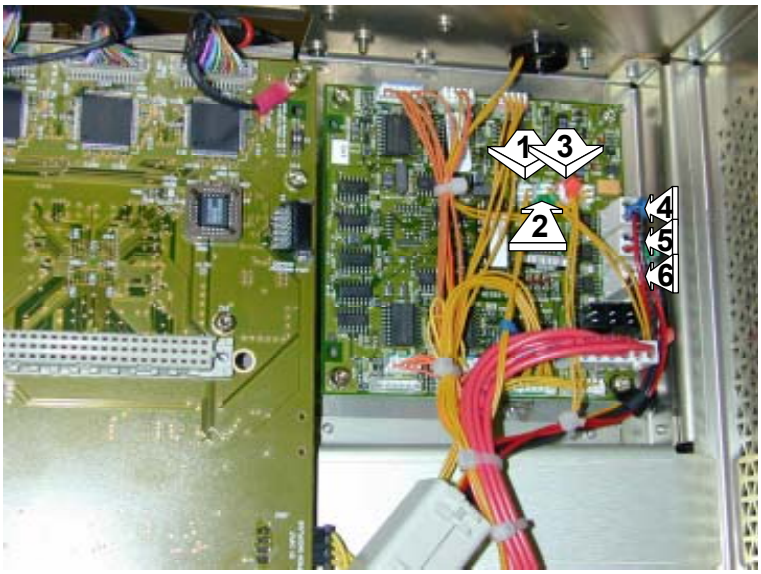


Image 27-97
Temperature sensor and Peltier element connection

1 blue temperature sensor connector

2 green temperature sensor connector

3 red temperature sensor connector

2. Plug in the Peltier element connectors 4, 5 and 6 (image 27-97).

4 blue Peltier element connector

5 green Peltier element connector

6 red Peltier element connector

3. Pull all wires of the Peltier elements and the temperature sensor into the black cable holder. Insert a Torx® screw and fixate to the right lower fixation point of the temperature and motor control board.

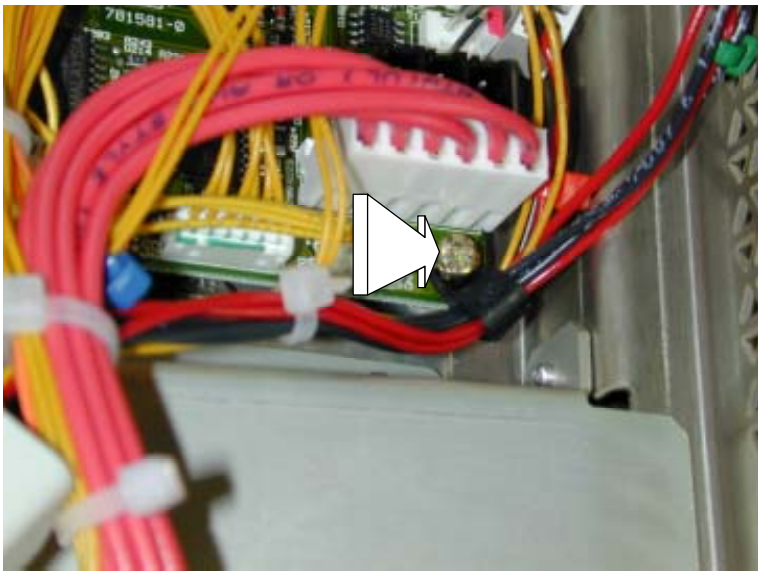


Image 27-98
Cable fixation

Mounting the core tube

1. Pull all wires of the temperature sensors and Peltier elements into the core tube.

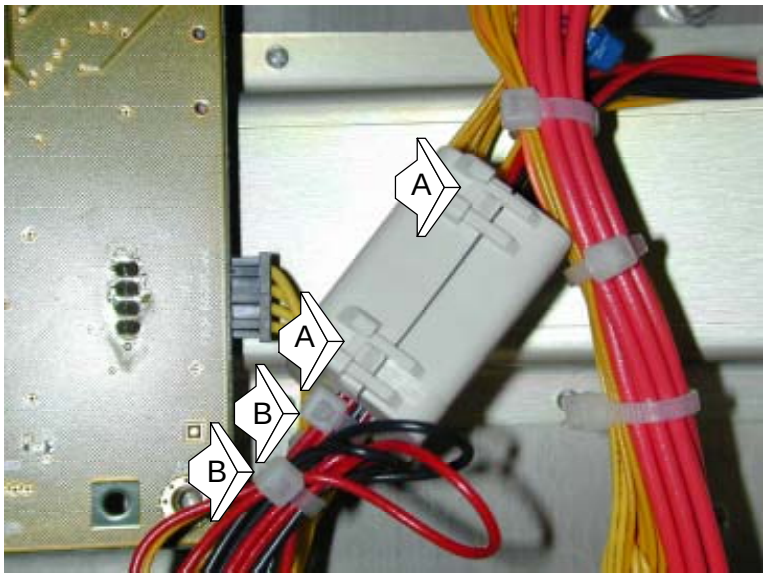


Image 27-99
Core tube mounting

2. Close the tube and push together until a click is heard (A).
3. Take the cables together and bind a wire tire around them (B).

Mounting the formatter power cables

1. Plug the plugs of the black power cables into the respective connectors (2, 3 and 4). The cables are labelled with a colored wire tire.

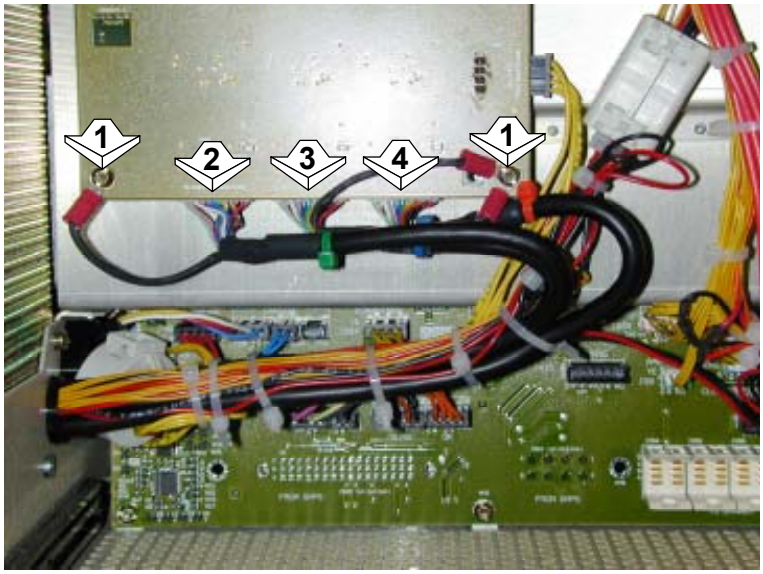


Image 27-100
Formatter power cables

2 green formatter power connector

3 blue formatter power connector

4 red formatter power connector

2. Take the green ground lead, insert a Torx® screw and fixate into left fixation hole of the formatter interface board (1 left).
3. Take the red and blue ground lead together, insert a Torx® screw and fixate into the right fixation hole of the formatter interface board (1 right).
4. Tie the cables and wires together as shown in image 27-100.

27.5.4.4 Mounting the lens holder ground leads

Necessary tools

Torx® driver TX10

How to mount ?

1. Check first if the metal fixation plate is mounted on the engine. If not, turn out the screw on the removed engine to take off the plate and mount this plate on the new inserted engine.

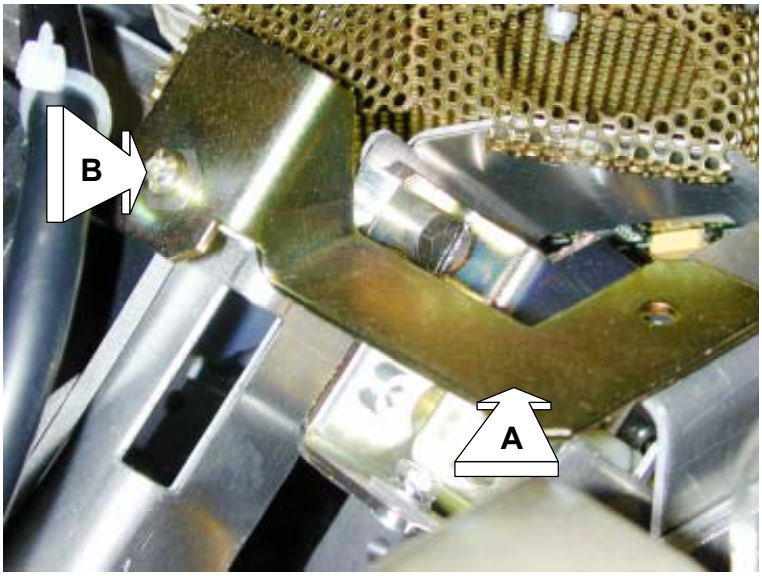


Image 27-101
Fixation plate engine-lensholder

2. Take the 3 ground leads together, plus the fixation plate and fixate with a Torx® screw.

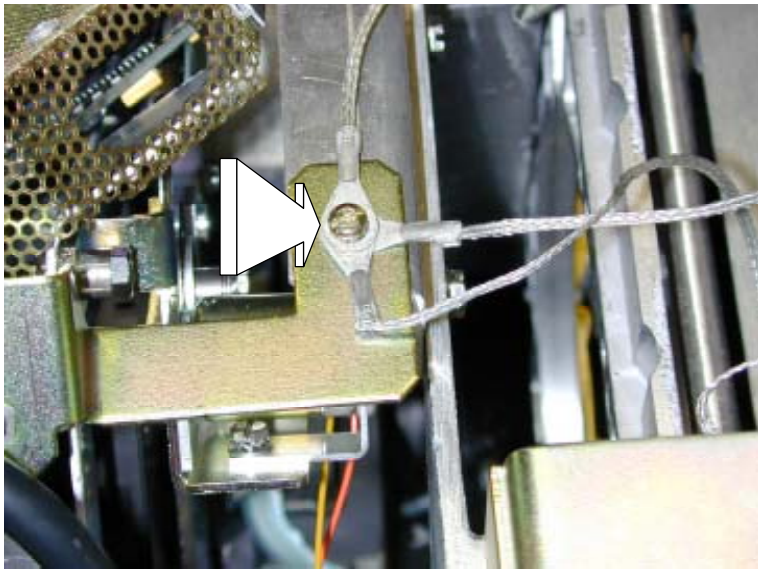


Image 27-102
Lens holder ground leads

27.5.4.5 Connecting the shutter

How to connect ?

1. Take the shutter cable (orange - yellow wires) on top of the shutter and connect with the shutter extension cable.

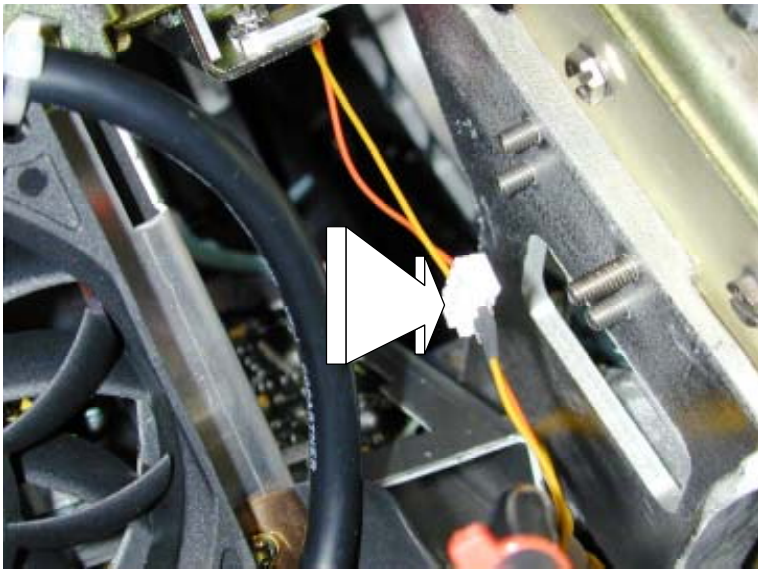


Image 27-103
Shutter cable connection

27.5.4.6 Connecting the lens sensor

How to connect ?

1. Connect the lens sensor cable through the lens holder gap (blue connectors).

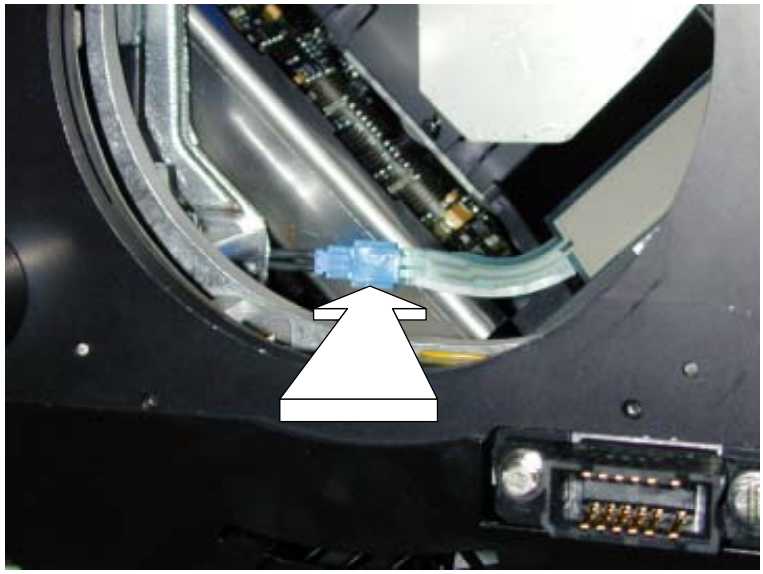


Image 27-104
Lens sensor cable

27.5.5 Re-assembling the projector

27.5.5.1 Mounting the Air channel

How to mount ?

1. Place the air channel in the projector with the fan to the engine.
2. Insert the two Torx® screws (1&2) fixating air channel unit to starter unit and turn in the bolt (3) fixating air channel unit to the optical base.

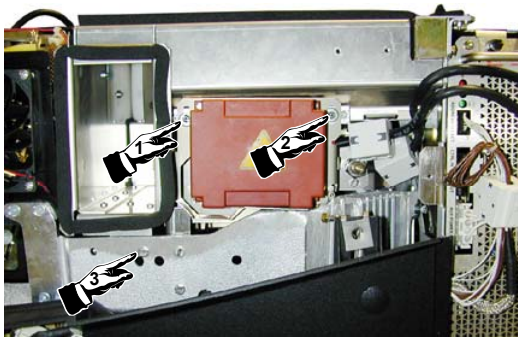


Image 27-105
Assembling the air channel

3. Mount the small L shape metal support plate, fixating air channel to frame, by turning in the three Torx® TX10 screws.

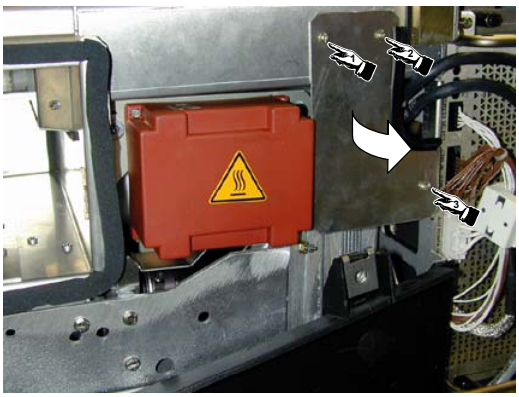


Image 27-106

4. Turn in the ten Torx® TX10 screws (A) on top of the air channel unit.

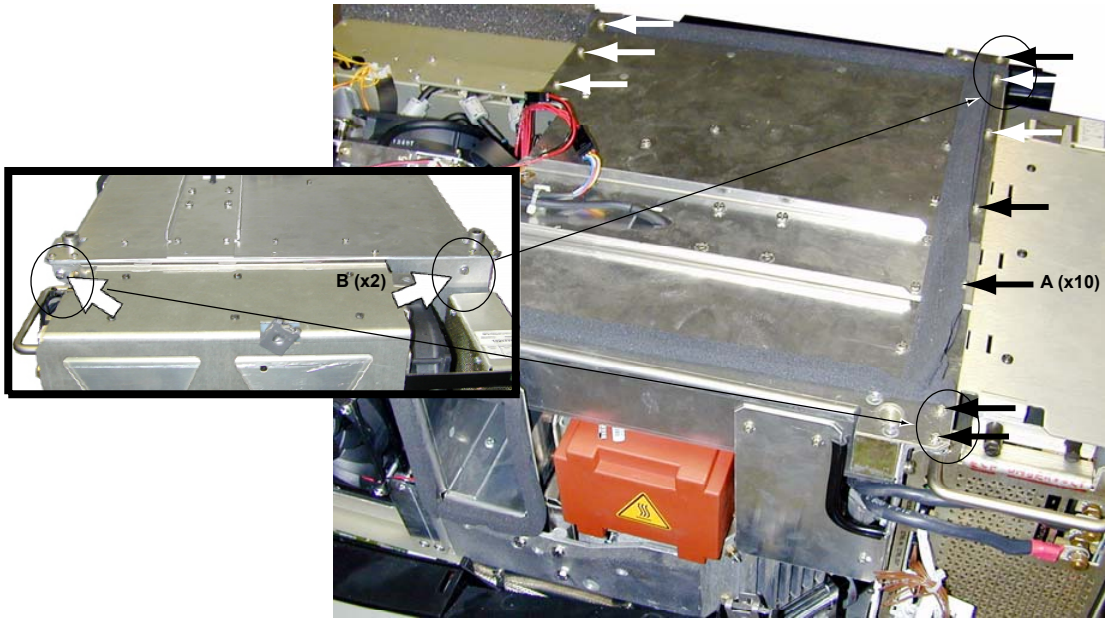


Image 27-107
Assemble air channel

5. Insert the two bolts (B) fixating the air channel unit to the lamp power supply house (image 27-107).
6. Connect onto the air channel the 3 engine ground leads by turning in the respective fixation screw (image 27-108).
   - (1) Ground connection top air channel
   - (2) Ground connection top air channel
   - (2) Ground connection side air channel
7. Connect the 2 fan cables on top of the unit by pushing the plug into its socket.
   - (3) Exhaust Fan
   - (4) Cooling Fan DMD Green

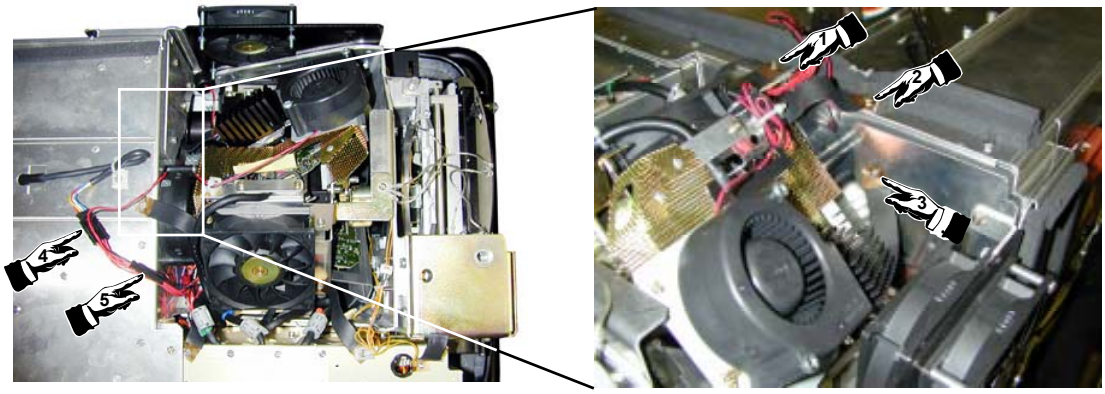


Image 27-108
Disconnection Fans and GND

27.5.5.2 Removing the SM Power Supply Module

Necessary tools

Flatblade screwdriver of 5mm

Inserting the SMPS module

1. Slide the module into the grooves of the projector frame.
2. Push the 3 plugs (A, B and C) on to their respective socket.

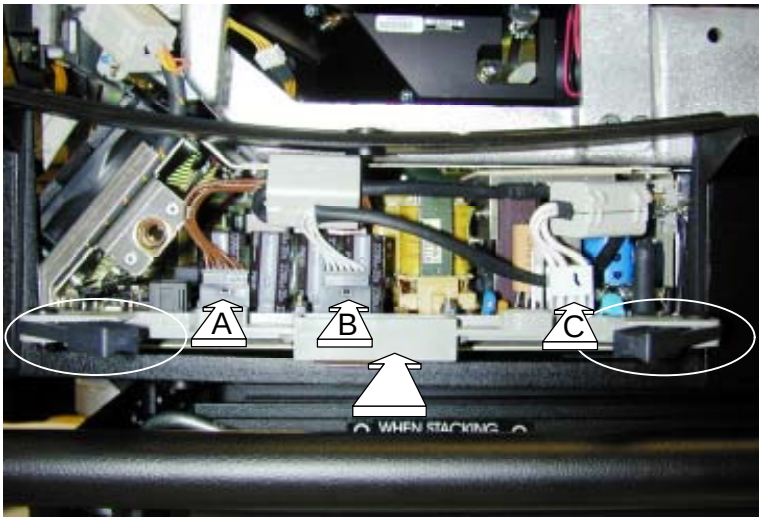


Image 27-109
Mounting the SMPS module

3. Push the module completely in and close the locks.

Closing the SMPS cover

1. Hook the metal cover door on the right side (A) and turn in to the projector (B).

Image 27-110
Mounting the metal cover

2. Lock the metal cover lock screw (B) by turning it half a turn clockwise.

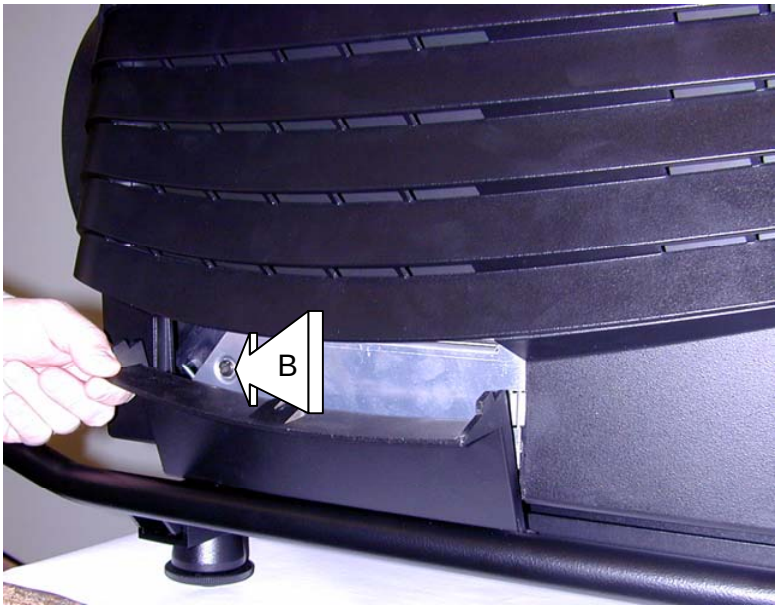


Image 27-111
Unlock lock screw

3. Place the side panel on its place.
4. Turn in the screw (A) of the plastic cover door.

Image 27-112
SMPS cover door screw

27.5.5.3 Installation of the Lamp Unit.

Necessary tools

Flatblade screwdriver of 5mm or Nut driver 8mm

Installing the lamp unit

1. Line up the lamp unit guides with the guides on the projector frame (B) and push the unit into the frame until it fits.

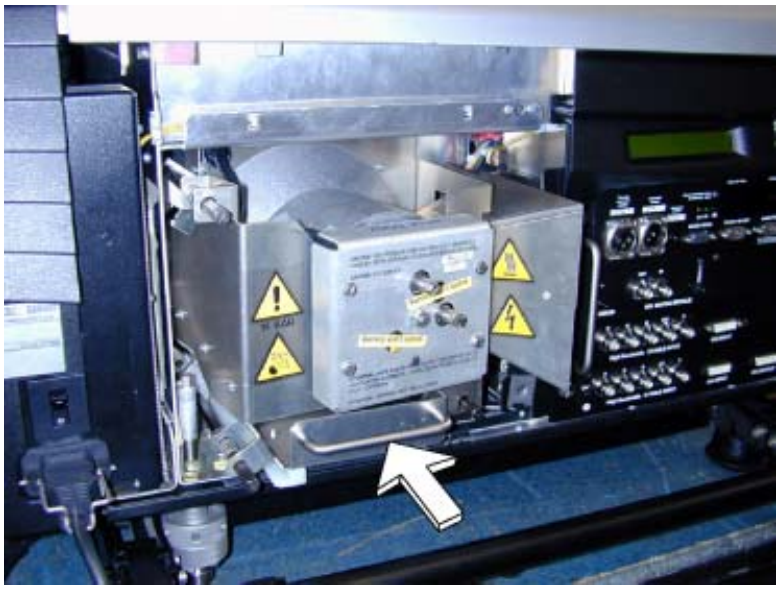


Image 27-113
Inserting the lamp

2. Secure the position of the lamp unit with the 3 spacer screws.

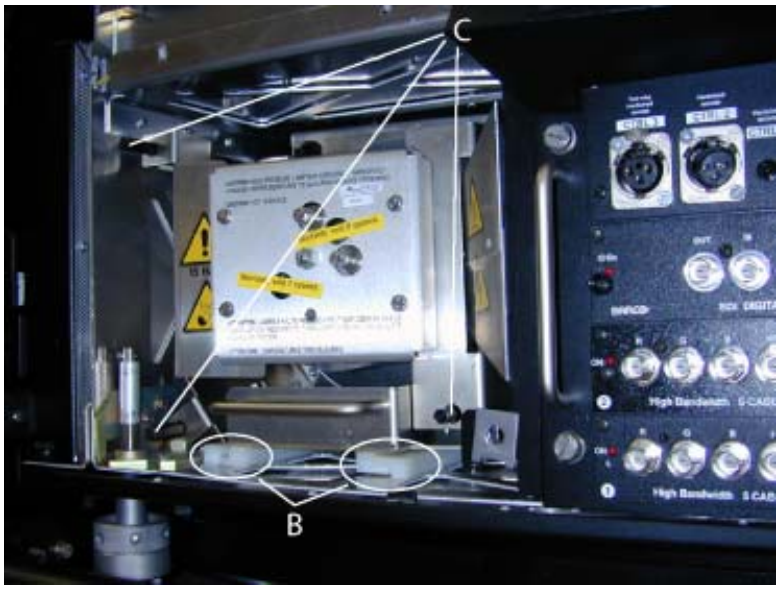


Image 27-114
Securing the lamp

27.5.5.4 Mounting the top cover

Mounting the top cover

1. Place the top cover on the projector.

Close the top cover fixation spring screws

1. Fasten 1 spring screws (1), holding upper side of top cover to projector main frame.

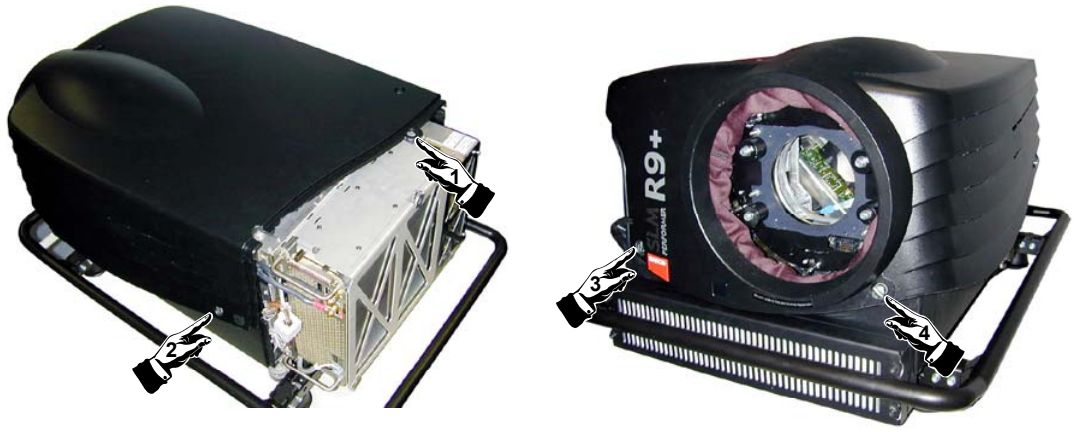


Image 27-115
Top cover fixation spring screws loosening

2. Fasten 1 spring screws (2), holding side of top cover to projector main frame.
3. Fasten 2 spring screws (3 & 4), holding front of top cover to projector main frame.

Mounting the stacking points

1. Insert the 3 stacking points on to the top cover.
2. Tighten the fixation bolt of the 3 stacking points, using an Allen key of 8 mm or a hex ball driver.

Connection of the dust protection cloth

1. Attach the dust protection cloth to the lens frame by inserting the 5 push fasteners..

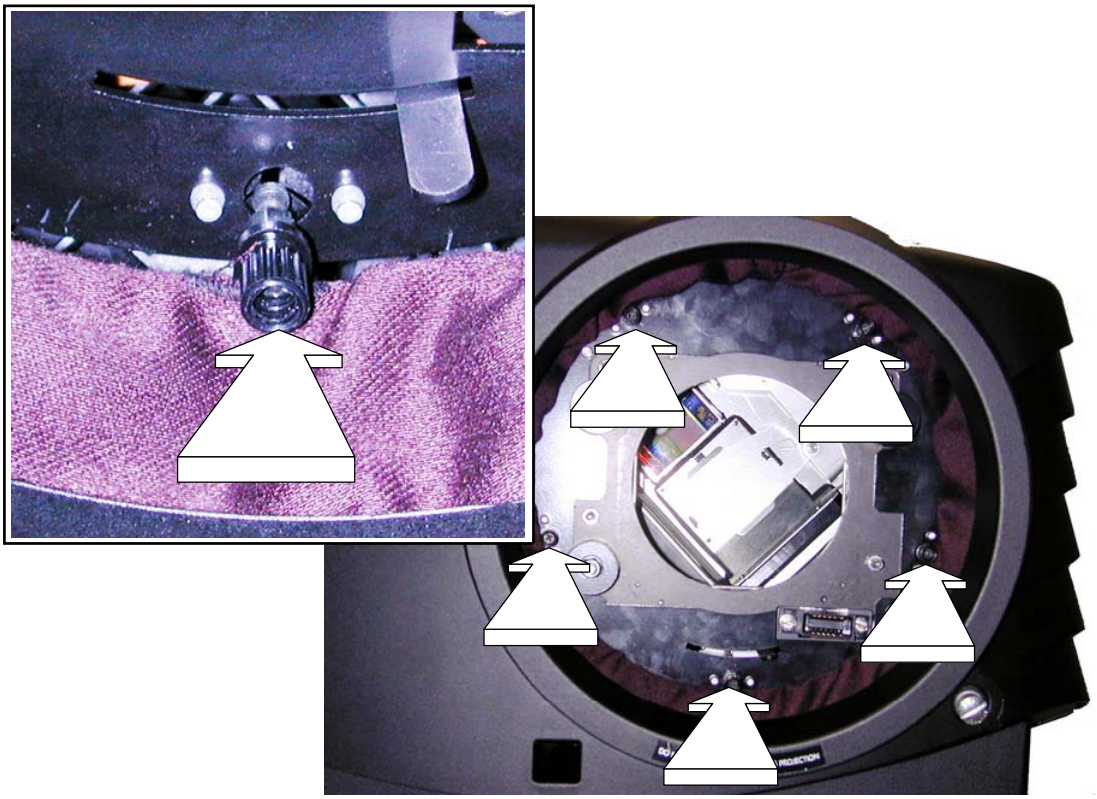


Image 27-116
Fastening dust cloth lens

27.5.5.5 Reinstalling the Side Panel

Necessary tools

A flatblade screwdriver of 5 mm

Reinstalling the side panel

1. Move the cover guides under the back cover and push the front of the cover against the projector frame lining up the cover lock screw with the speed nut (A) on the frame.

Image 27-117
Mounting the side cover

2. Turn with a screwdriver the side panel lock screw (B) a quarter turn clockwise to lock.

27.5.5.6 Lens Installation

How to install ?

Follow the next procedure:

1. Move the handle (A) of the lens anchor system to the right.

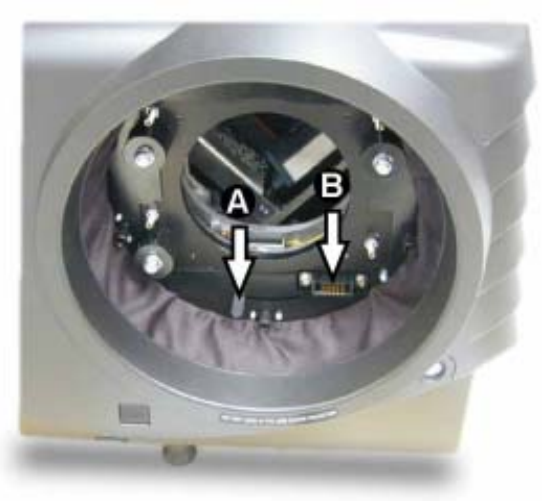


Image 27-118
Lens installation

2. Push the lens, motors at the top, in the lens block gap horizontally, lining up the motor connector on the lens with the connector on the lens block (B), until the lens clicks in the lens anchor system.

Image 27-119
Mounted Lens

27.5.5.7 Mounting the back cover

How to mount ?

1. Slide the back cover over the rear of the projector.

Image 27-120

2. Turn with a screwdriver the 3 quarter turn fasteners a quarter turn clockwise (A).

27.5.5.8 Inserting the Input panel

How to mount ?

1. Take the input panel by the 2 handles (A) and push into the projector.

Image 27-121

2. Secure the 4 spring screws (B), holding Input Panel Box to projector main frame.

27.6 Replacement of the Light Integration Rod

Overview

- General Info
- Replacement procedure
- Alignment of the Light Integration Rod

27.6.1 General Info

View of the Light Integration Rod

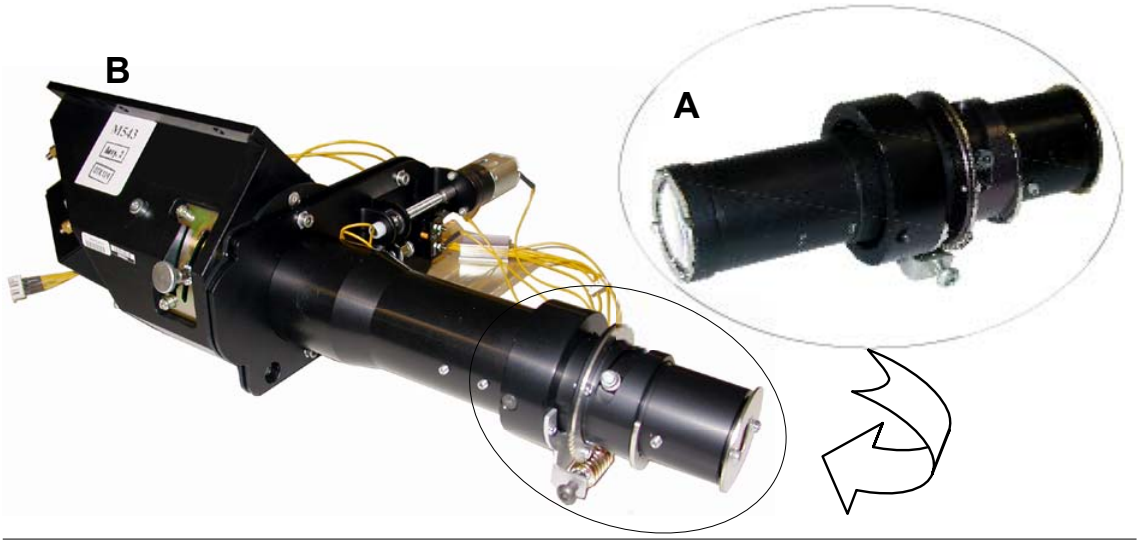


Image 27-122
View of the Light Integration Rod

Order Info

Image Ref.	Order No.	Description
A	R849700	DLP™ Light Integration Rod
B	R840546	DLP™ Light Unit Complete

27.6.2 Replacement procedure

Overview

- Removing the air channel unit
- Removing the start pulse generator
- Removal of the Light Integration Rod
- Installation of the Light Integration Rod

27.6.2.1 Removing the air channel unit

WARNING: The projector has to be turned off and disconnected from the wall outlet to minimize the risk of electric shock.

WARNING: Always let the projector cool down after operation in order to reduce the heat on parts in the light path and to avoid burns.

Necessary tools

- Flat blade screwdriver of 5 mm
- Torx® driver TX10
- Nut driver of 5,5 mm
- Nut driver of 7 mm

How to remove the air channel unit

1. Remove the small L shape metal support plate, fixating air channel to frame, by releasing three Torx® TX10 screws.

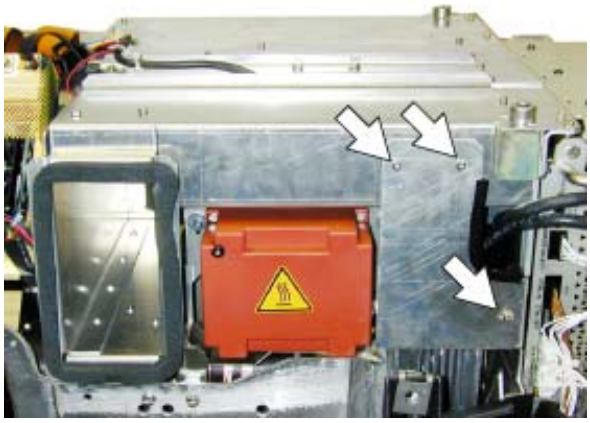


Image 27-123

2. Disconnect the two fan cables on top of the unit and the three engine ground leads.

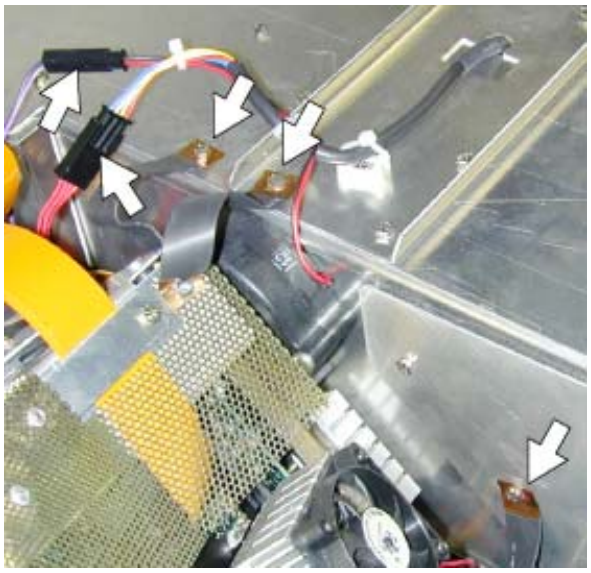


Image 27-124

3. Remove the two Torx® screws fixating air channel unit to starter unit and remove the bolt fixating air channel unit to the optical base.

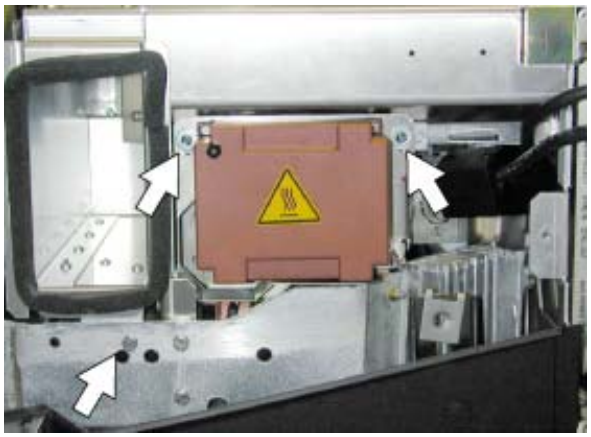


Image 27-125

4. Remove the two bolts fixating the air channel unit to the lamp power supply house.

Image 27-126

5. Remove the ten Torx® TX10 screws on top of the air channel unit.

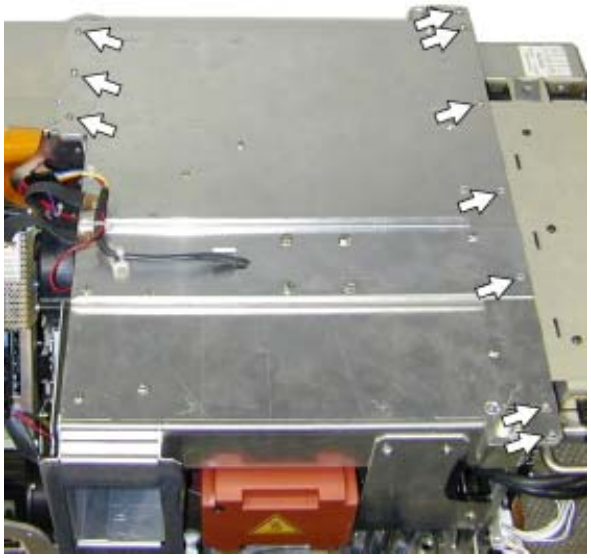


Image 27-127

6. Remove the air channel unit by gently lifting it up.

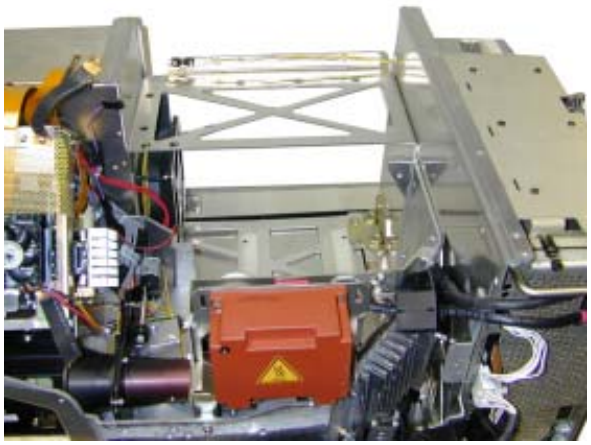


Image 27-128

27.6.2.2 Removing the start pulse generator

Necessary tools

Nut driver of 7 mm

How to remove the start pulse generator

1. Remove the four bolts, fixating the start pulse generator to the main frame

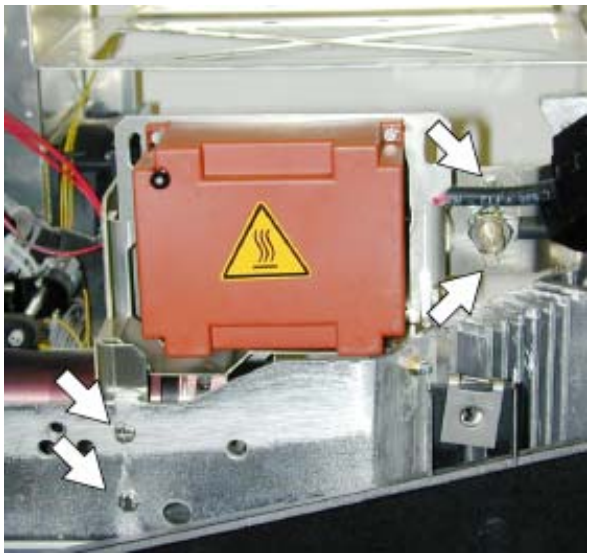


Image 27-129

2. Displace the start pulse generator.

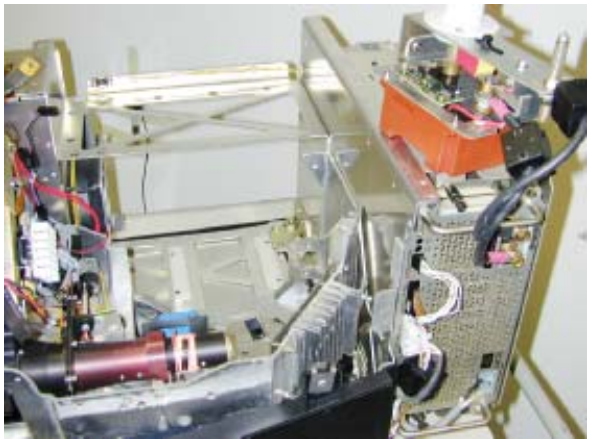


Image 27-130

27.6.2.3 Removal of the Light Integration Rod

CAUTION: The light integration rod cannot be slit out the light pipe for reason of not enough space behind (hits the cold mirror). For that reason, always detach the light pipe from the folding mirror assembly for the replacement of the light integration rod.

Necessary tools

- Small cross head screwdriver
- Ballpoint Allen key 1,5 mm and 2 mm

How to remove

1. Remove the 3 screws (A), using an Allen key of 2 mm, securing the light pipe assembly onto the folding mirror assembly.

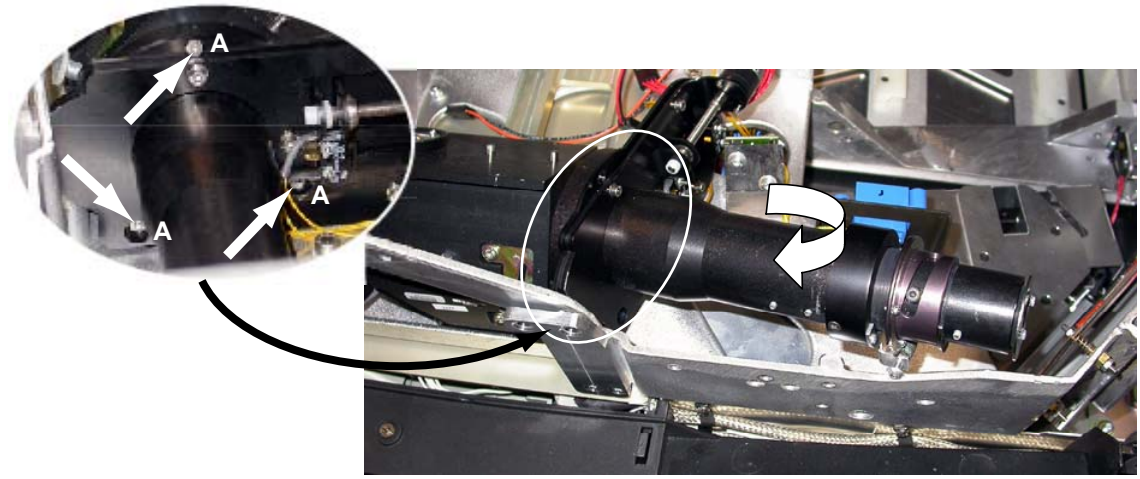


Image 27-131
Light pipe assembly removal

2. Carefully place the light pipe assembly onto the projector frame border.

   All screws for the light integration rod removal are accessible.

3. Loosen the 2 hexagon socket screws (A) , using an 1.5 mm ballpoint Allen key, clamping the rod inside the light pipe.

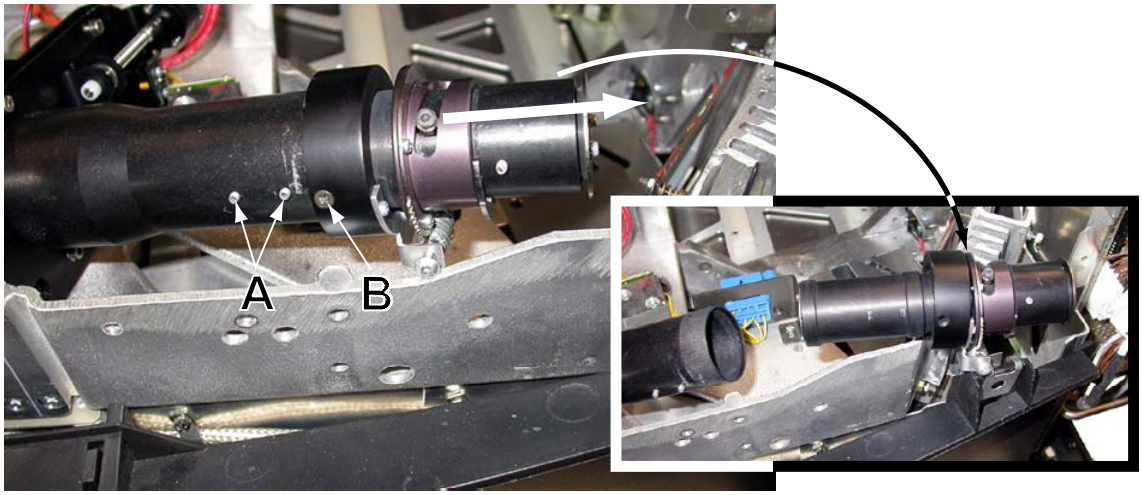


Image 27-132
Light integration rod removal

4. Remove the cross head screw (B), using the small cross head screwdriver, securing the light integration rod onto the light pipe.
5. Slide the light integration rod out the light pipe.

27.6.2.4 Installation of the Light Integration Rod

Necessary tools

- Small cross head screwdriver
- Ballpoint Allen key 1,5 mm and 2 mm

How to install the light integration rod

1. Slide the integration rod assembly, lens facing light pipe entry and worm wheel facing bottom projector, inside the light pipe.
   Note: *Ensure the worm wheel is standing halfway the gear wheel before mounting the light integration rod in the light pipe.*

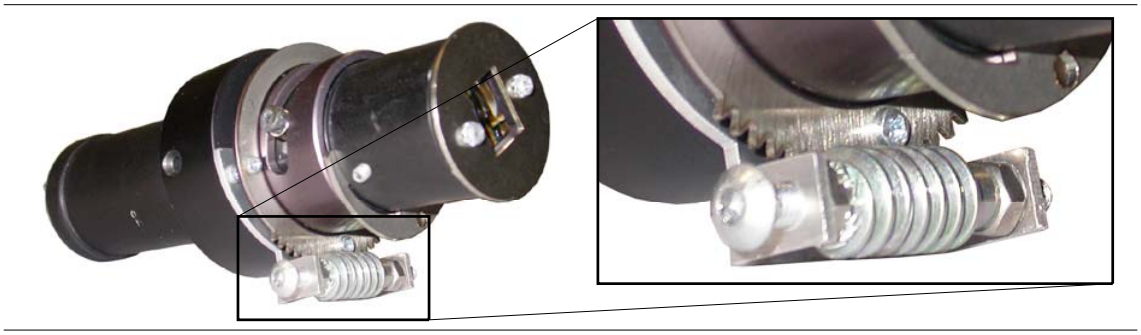


Image 27-133
Position of the worm wheel

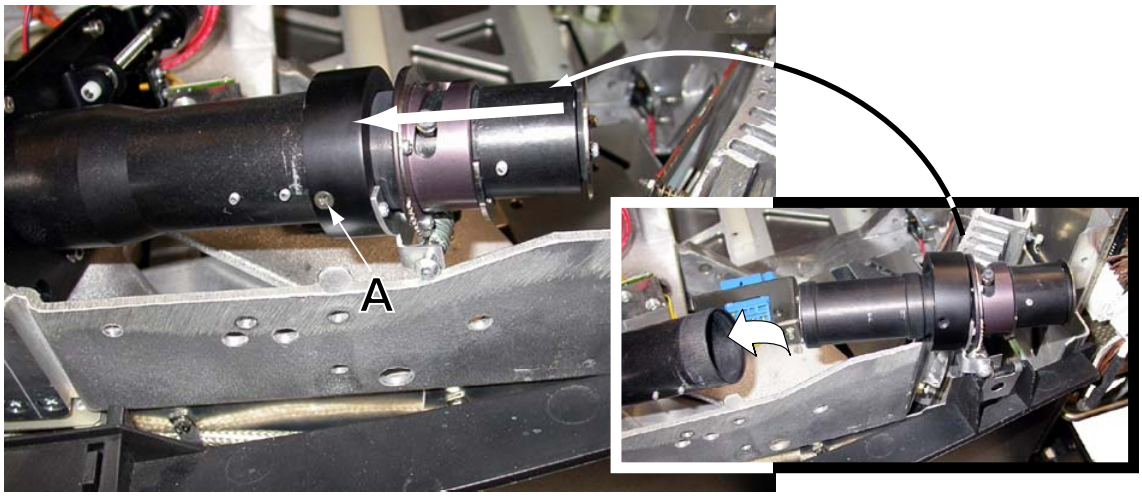


Image 27-134
Mounting the light integration rod

2. Rotate the rod until the hole in the fixation ring matches the threaded hole in the light pipe and secure the position of the rod with the cross head screw (A).
3. Next, consecutively proceed to the reinstallation of:
   - the light pipe onto the folding mirror assembly (see "Removal of the Light Integration Rod", page 250.)
   - the start pulse generator (see "Removing the start pulse generator", page 249)
   - the air channel (see "Removing the air channel unit", page 247)
4. Finally, proceed to the adjustment of the light integration rod (Focus and light spot on the DMD's).

27.6.3 Alignment of the Light Integration Rod

WARNING: Never start up the projector without light integration rod installed.

About the alignment

The position of the light integration rod into the light pipe has to be aligned for 2 reasons:

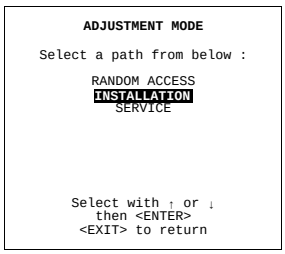
- Focusing of the light spot
- Framing the DMD's on the light spot

For the alignment, a purity pattern is required. A suchlike pattern is available in the projector installation menu, sub item "Internal patterns".

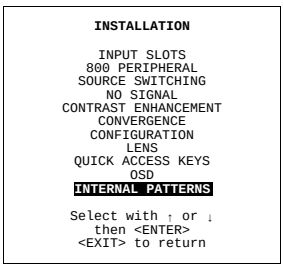
27.6.3.1 Select internal black purity pattern

How to select the internal black purity pattern ?

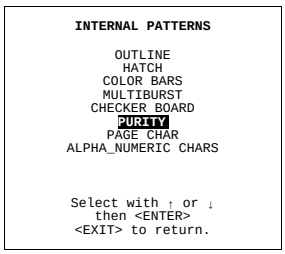
1. Start the projector and enters the adjustment mode (see installation manual of the projector).
2. Consecutively selects menu items INSTALLATION, INTERNAL PATTERN and finally PURITY.



Menu 27-1



Menu 27-2



Menu 27-3

3. Press **ENTER** to display the purity pattern.
4. Push the cursor key ↑ to select '<<RGB>>'

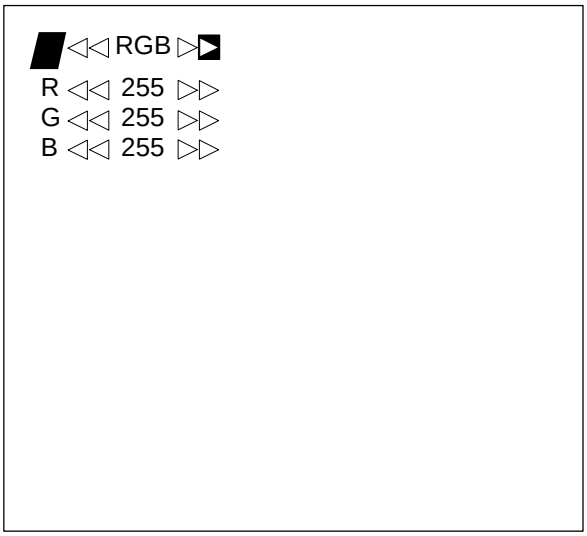


Image 27-135

5. Push the cursor key < to select the left arrow of '<<RGB>>'
6. Press **ENTER** to switch to full black image.

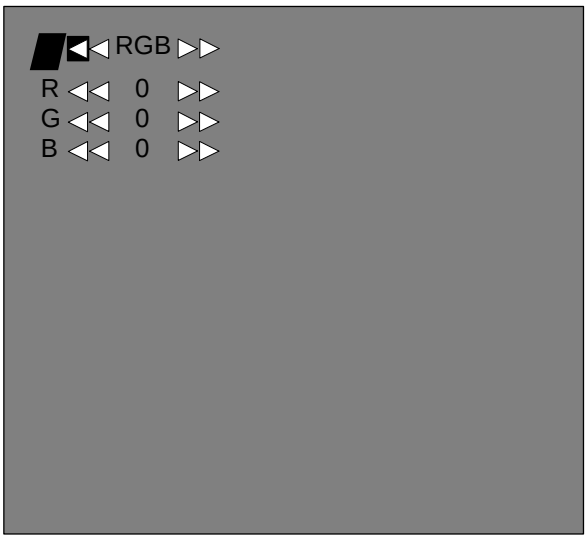
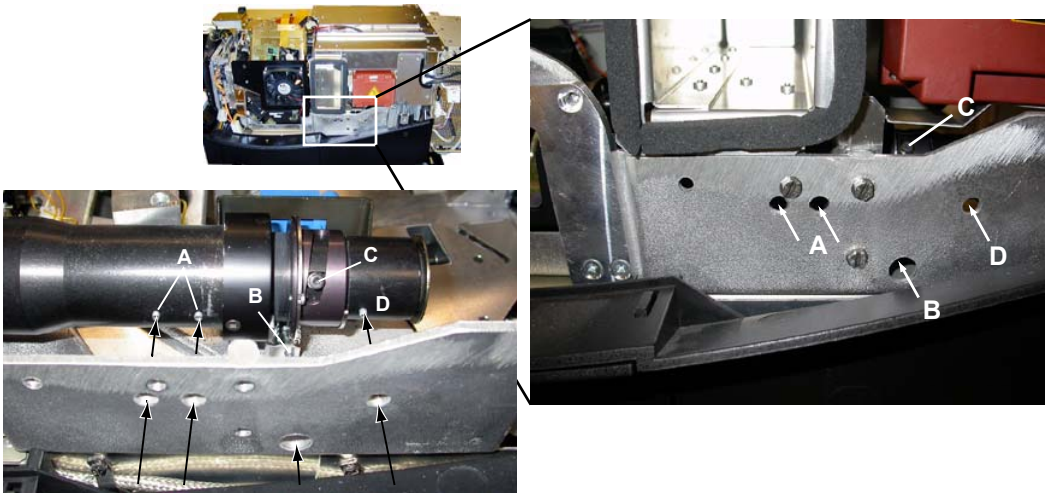


Image 27-136

27.6.3.2 Access to the controls for the alignment

How to reach



Air channel & Start Pulse Generator removed

Image 27-137
Access to the controls for the alignment

Image Ref.	Explanation
A	2 hexagon socket screws, blocking the light pipe holder in the light tube. These screws are accessible through 2 holes in the base frame.
B	Hexagon socket screw for adjusting the worm wheel. This screw is accessible through a hole in the base frame.
C	Light pipe adjustable screw. This alignment is FACTORY PRESET.
D	1 hexagon socket screw, blocking the light pipe in its holder. This screw is accessible through a hole in the base frame.

27.6.3.3 Focusing the Light Spot

Necessary tools

Ballpoint Allen key of 1.5 mm and 2.5 mm.

How to focus

1. Loosen (Allen key of 1.5 mm) the 2 hexagon socket screws (A), securing light pipe support in the light tube.
   Note: *Ensure the hexagon socket screw (D) is still tightened.*

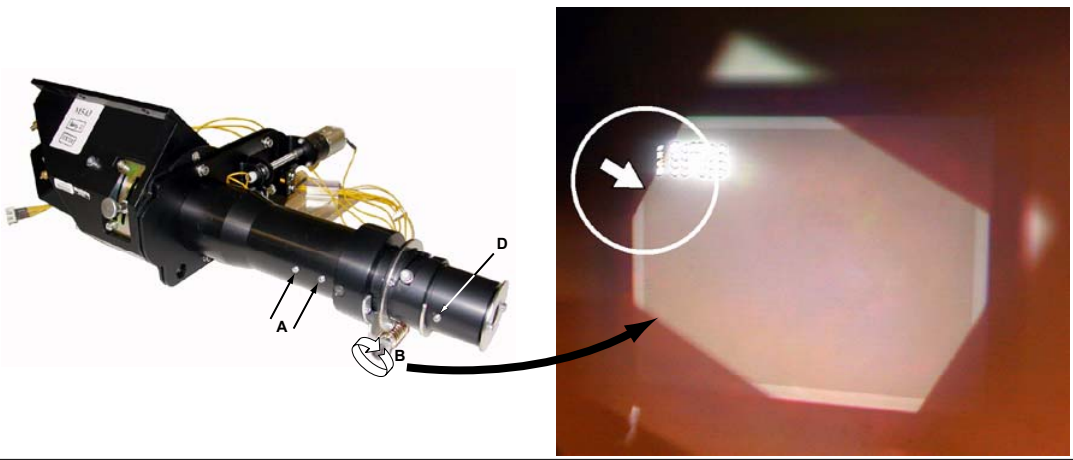


Image 27-138
Focusing the light pipe

2. Rotate clockwise the worm wheel (B) (Allen key of 2.5 mm) until the borders of the light spot are outlined in the corner of the screen.
3. Sightly tighten one of the hexagon socket screws (A) (light pipe must be able to move horizontally in the light tube).
4. Loosen (Allen key of 1.5 mm) the hexagon socket screws (D), securing light pipe in its support.
5. Rotate the worm wheel (B) (Allen key of 2.5 mm) until the outline of the light spot borders are as sharp as possible.
6. Secure the position of the light pipe in its support by tightening the hexagon socket screw (D).
7. Next, proceed to the matching of the light spot with the DMD™ outline (DMD=Digital Micro-Mirror Device).

27.6.3.4 Matching the Light Spot to the DMD™ outline

Necessary tools

Ballpoint Allen key of 1.5 mm and 2.5 mm.

How to align

1. Loosen (Allen key of 1.5 mm) the 2 hexagon socket screws (A), securing light pipe support in the light tube.

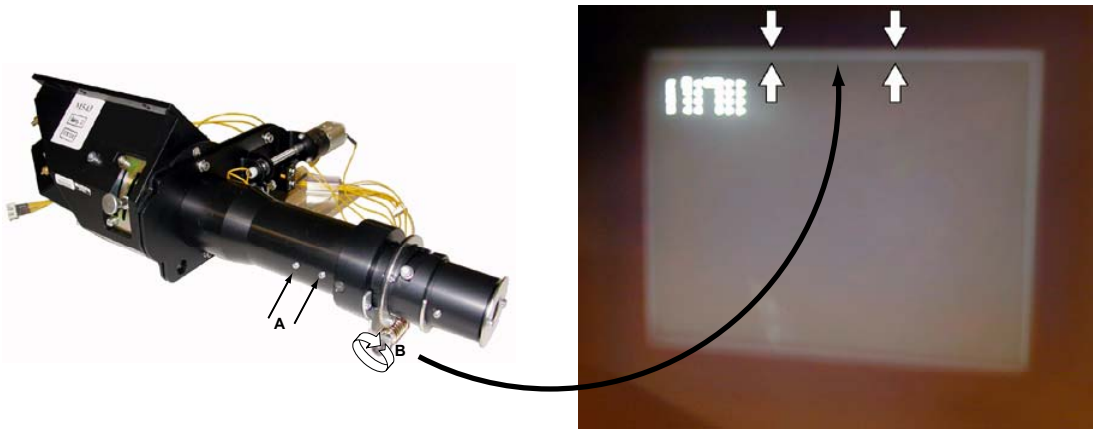


Image 27-139
Matching the light spot to the DMD outline

2. Rotate the worm wheel (B) (Allen key of 2.5 mm) until the light spot matches the outline of the DMD.
3. Secure the position of the light pipe support in the light pipe tube by tightening the 2 hexagon socket screw (A).

28. UPGRADE WITH AIR FILTERS

28.1 Air Filter Upgrade Kit for SLM R12+

28.1.1 Location of the Dust Filters

Where mounted

See "Location of the Dust Filters", page 187

28.1.2 Contents of the Kit

Parts listing Kit

Image 28-1

Image 28-2

Part Number	Description
R847318	FRM R12SLM+ FLTR BACK
R846661	HSGC SLM R9+ BTM
R846525	SPR L4 D15 D9 AL
R846524	FRM R9SLM+ HDL FIX PLT
B362902	NUT FLAT HEAD M 6 STNI
B361242	SCR $7380 M 6 X 8 STZN
R847506	FRMC R12SLM+ IR RX MNT
R763261	UN G10ELM RCU RX IR RC5
R847964	SPR L 2,5 D10,2D14 AL

28.2 Disassembling the projector for Cover replacement

Overview

- Step by step actions
- Disassembling Steps

28.2.1 Step by step actions

Disassembling the projector

1. Remove the lamp cover.
2. Remove the Input assembly.
3. Remove the rear cover.
4. Remove the top cover.
5. Remove 2 stacking points
6. Remove the carrying handle.
7. Remove the bottom cover

28.2.2 Disassembling Steps

28.2.2.1 Removing the lamp cover

Necessary tools

A flatblade screwdriver of 5 mm

How to remove

1. Turn with a screwdriver the side panel captive screw (A) a quarter turn counter clockwise.

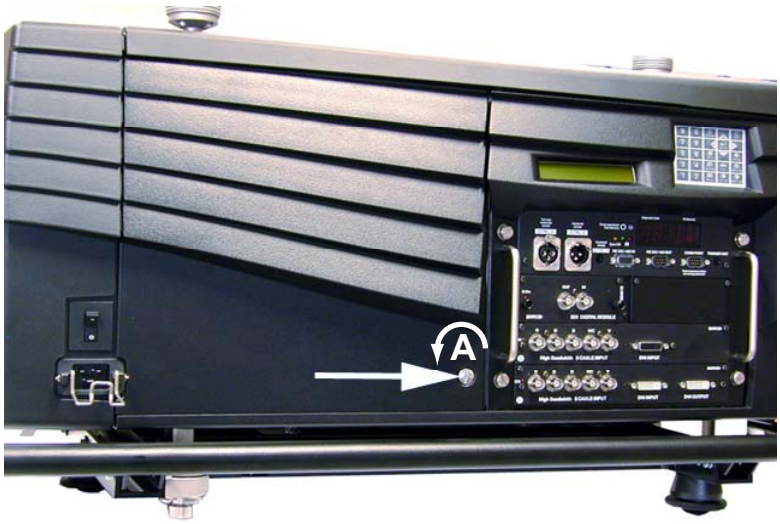


Image 28-3
Unlocking the side cover

2. Pull the right side of the panel towards you and next to the right to remove.

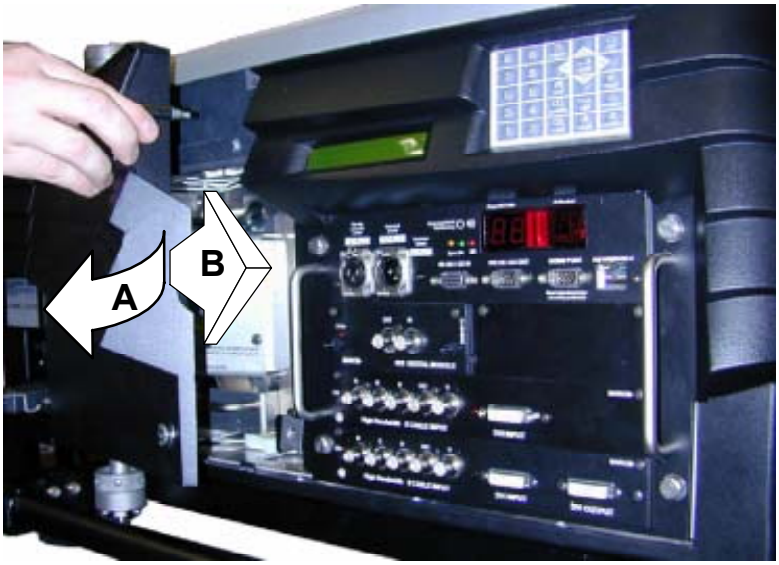


Image 28-4
Lamp cover removal

28.2.2.2 Removing the Input Assembly

Necessary tools

A flat blade screwdriver of 5 mm

How to remove the Input Assembly

1. Loosen the 4 captive screws (A), holding Input Panel Box to projector main frame.

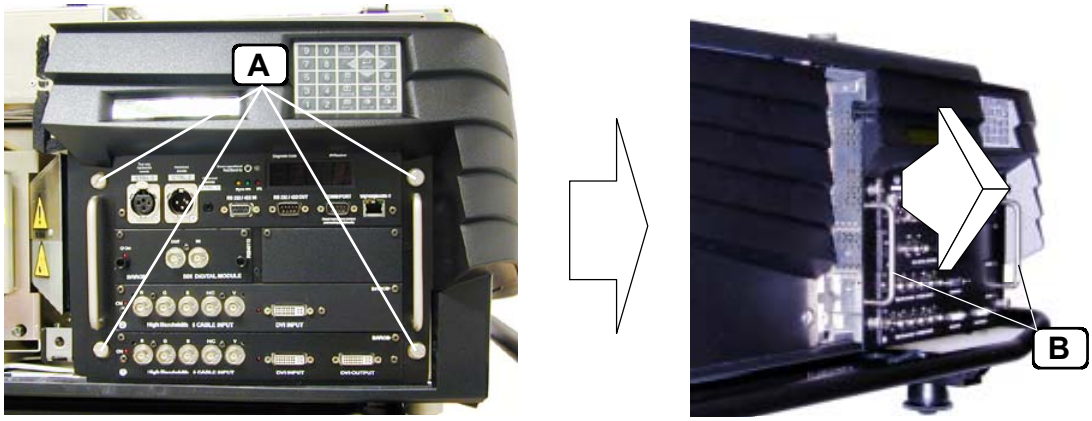


Image 28-5
Removal Input Panel Box

2. Take the input panel by the 2 handles (B) and pull it out the projector.

28.2.2.3 Removing the Rear Cover

How to remove the Rear Cover

1. Loosen the 3 spring screws (A), holding the back cover to projector main frame.

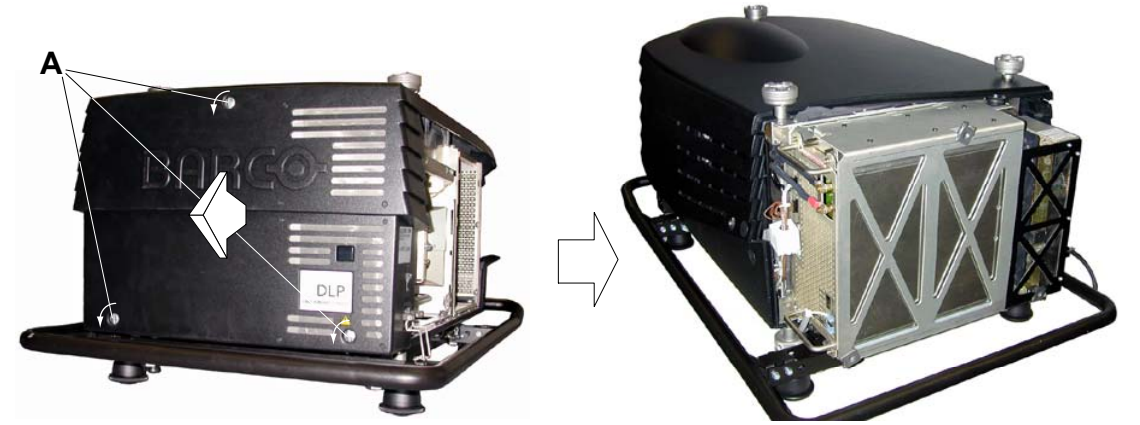


Image 28-6
Rear cover removal

2. Slide backwards the rear cover to remove.

28.2.2.4 Removing the Top Cover

Necessary tools

Allen key of 8 mm

Removal of the stacking points

1. Loosen the fixation bolt of the 3 stacking points on top of the projector, using an Allen key of 8 mm.

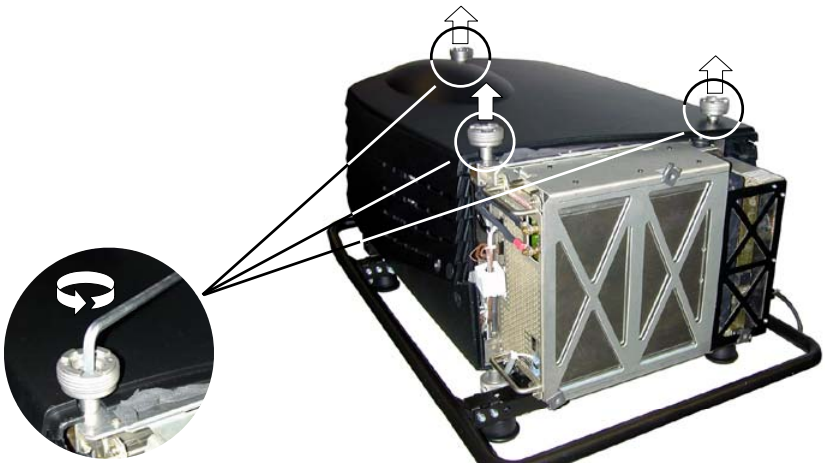


Image 28-7

2. Remove the 3 stacking points upwards.

Loosening the top cover fixation captive screws

1. Loosen 2 captive screws (3 & 4), holding front of top cover to projector main frame.

Image 28-8
Loosening the cover fixation captive screws

Disconnection of the dust protection cloth

1. Hold the lens with one hand and move the lens lock clockwise (picture A).

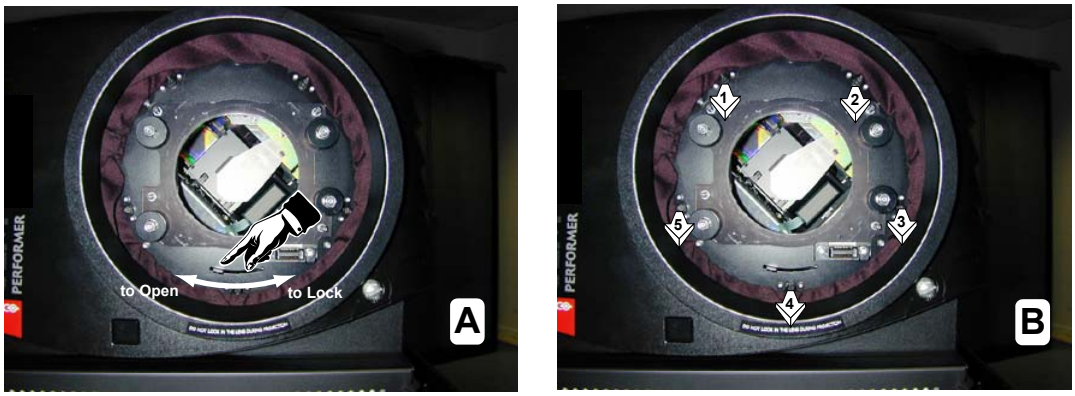


Image 28-9
Removal Lens and dust cloth

The lens lock is unlocked and the lens can be removed from lens block.

2. Disconnect the dust protection cloth ring from lens block by pulling the ring backwards (picture B).

Removal of the top cover

1. Lift up the top cover to remove (A).

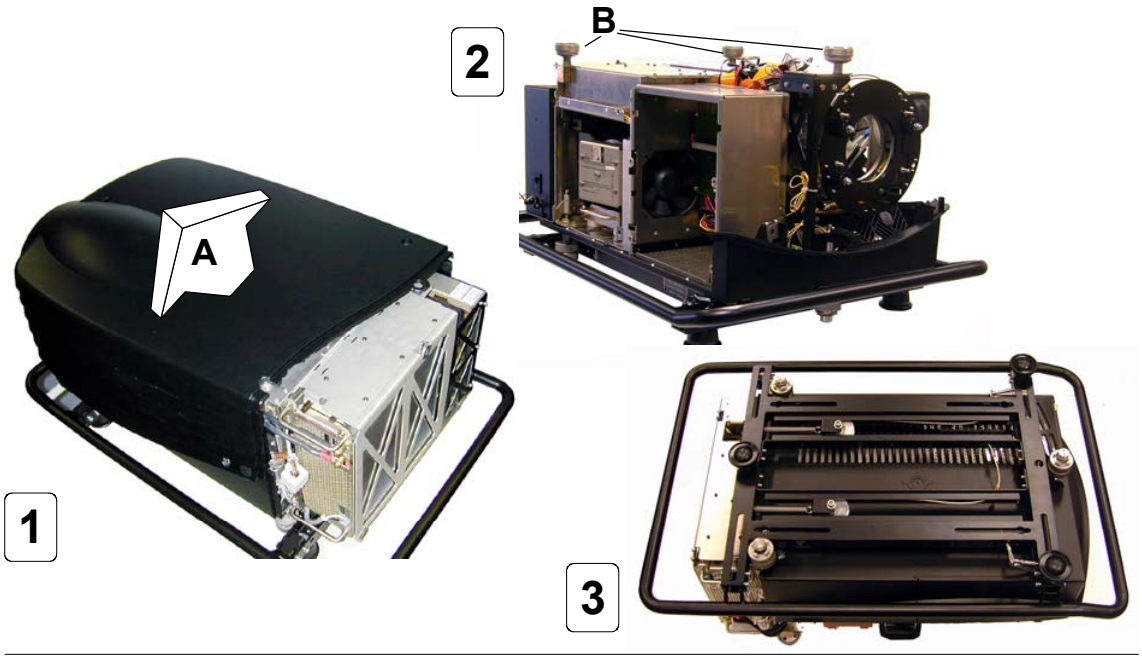


Image 28-10
Turning the projector upside down

2. Reinstall the stacking point on top of the projector (B).
3. Turn the projector upside down.

28.2.2.5 Removal of the Carrying Handle

Necessary tools

- Allen Key of 2.5 mm and 8 mm .
- Small flat blade screwdriver.

How to remove

Before attempting to remove the bottom cover, 2 bottom stacking interlocks have to be disassembled (see illustration for location of the stacking interlocks to be removed).

1. Remove 2 bottom stacking point as follows: (procedure is the same for both).
   - Remove hexagon socket screw (A), using an Allen key of 2.5 mm .
   - Slide the metal tube (B) upwards from stacking interlock.
   - Turn the stacking interlock top counterclockwise to remove.

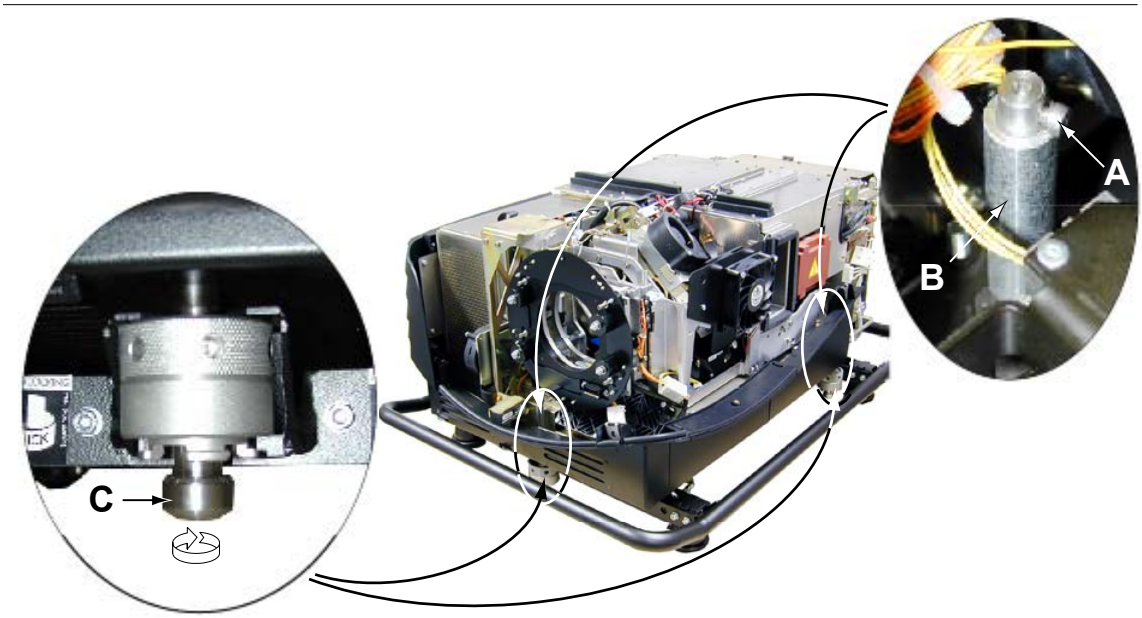


Image 28-11
Removal bottom stacking interlock

2. Remove the 3 hexagon socket screws (A), securing carrying handle to frame, using Allen key of 8 mm .

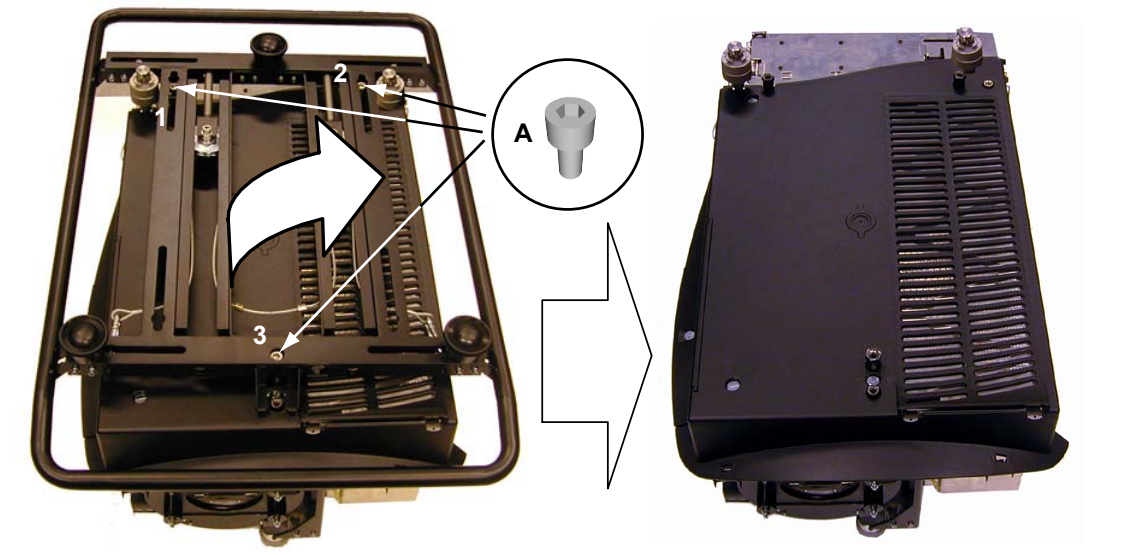


Image 28-12
Removal of the carrying handle

3. Remove the carrying handle.

28.2.2.6 Removal of the Bottom Cover

How to remove

1. Remove the 3 fixation studs (A) for the carrying handle.

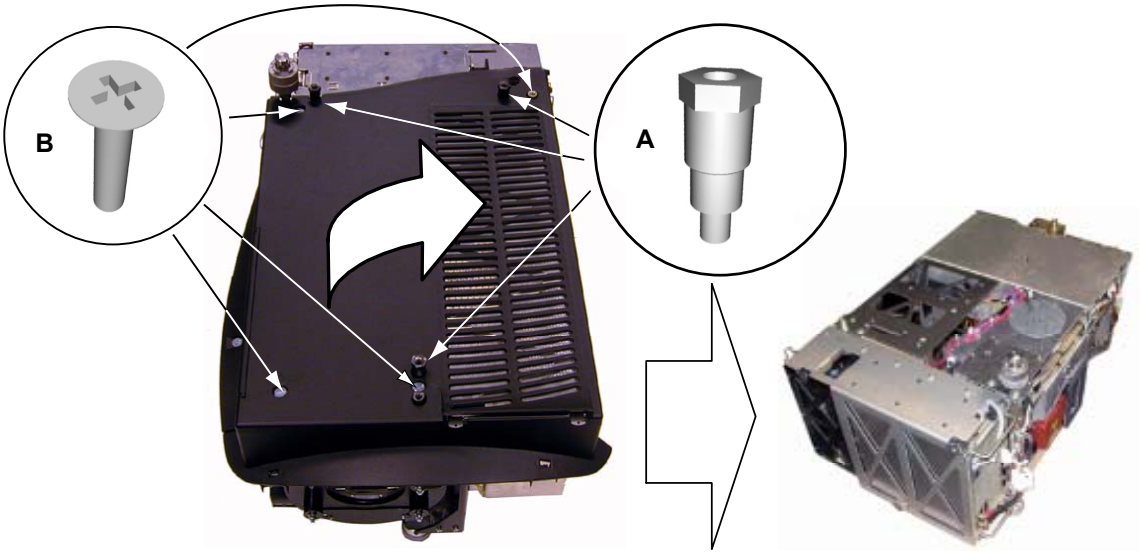


Image 28-13
Removal of the bottom cover

2. Remove the 4 screws (B), securing the bottom cover to projector base.
3. Remove the bottom cover.

28.3 Reassembling the projector with kit parts

28.3.1 Step by step actions

Replacement of the bottom and rear cover provided with air filters

1. Mount the bottom cover provided with air filters.
2. Mount the new spring fixation plate for the safety cable (side input assembly).
3. Mount the 3 carrying handle fixation studs, inserting a plain washer.
4. Mount the carrying handle.
5. Mount the 2 removed stacking points
6. Successively, mount back top, rear and lamp cover and last one the input assembly.

28.3.2 Reassembling Steps

28.3.2.1 Adaptation of the Safety cable tightening unit

Necessary tools

Allen key of 6 mm and 2.5 mm.

How to adapt

When attempting to reinstall the carrying handle, the safety cable tightening unit (side air channel) will collide with the added air channel on the new bottom cover. For that reason, the safety cable tightening unit on the carrying handle has to be adapted.

1. Disassemble the safety cable tightening unit as follows:
   - Remove the 2 screws (A) holding spring support (B) to U-bracket (C).
   - Remove the bolt (D) securing the safety cable tightening assembly.

   Note: only the wheel of the assembly will be reused.

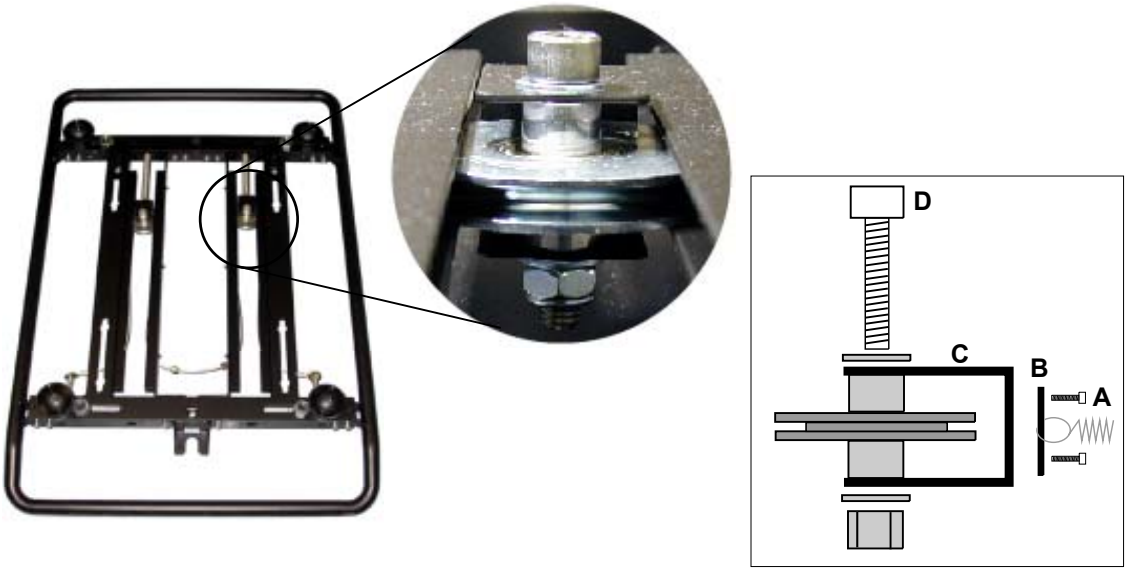


Image 28-14
Disassembling the spring fixation unit.

2. Reassemble the safety cable tightening, using the part added to the kit, as follows:
   - Fix the spring support plate (A) onto the wheel using the parts added to the kit.

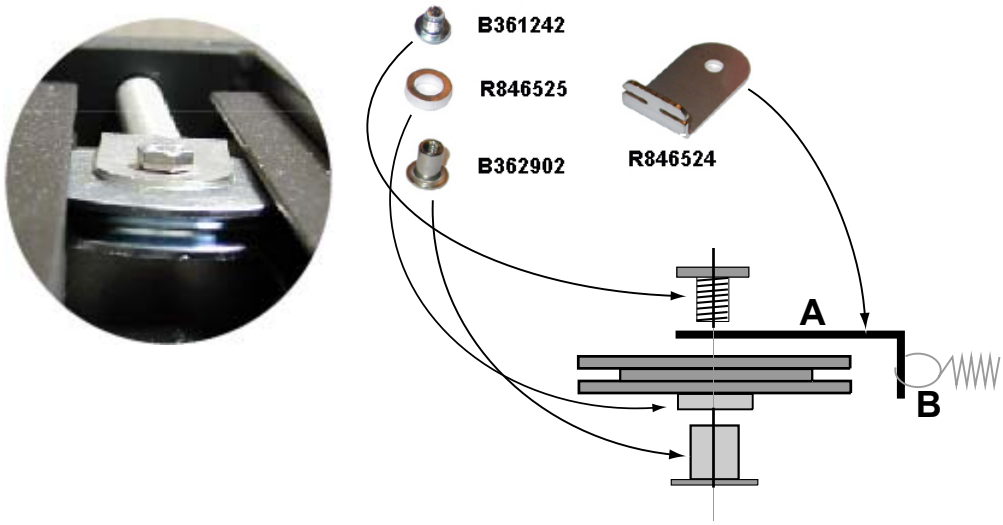


Image 28-15

- Clips the spring eye (B) into the notches on the top of the spring support plate.

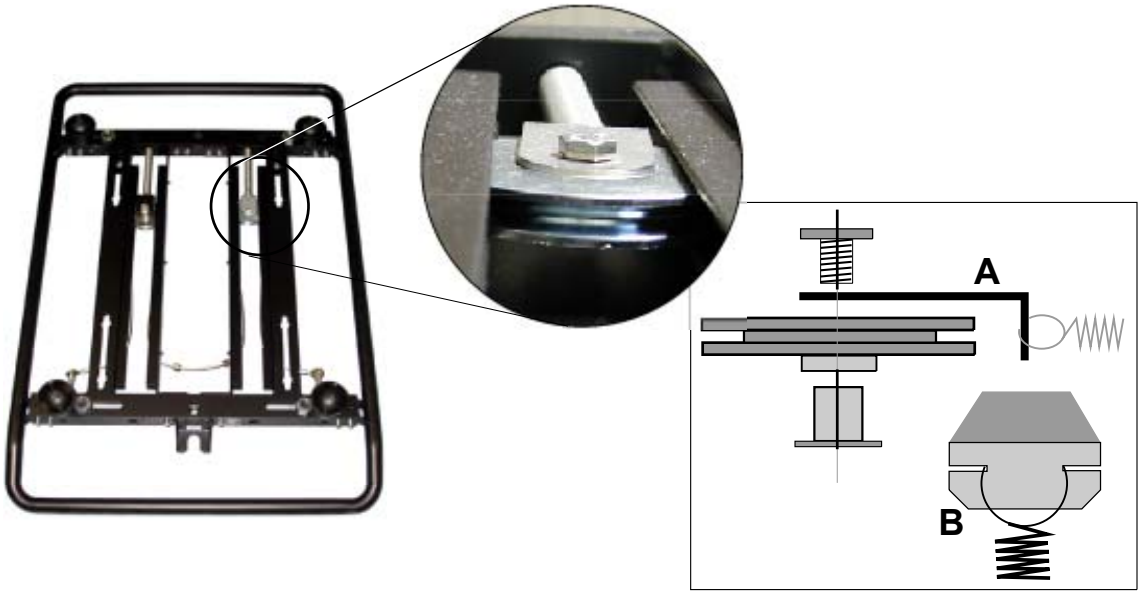


Image 28-16
Disassembling the spring fixation unit.

28.3.2.2 Mounting the Bottom Cover with Air Filters

How to assemble

1. Place the bottom cover (A), with air filter, onto the projector underside.

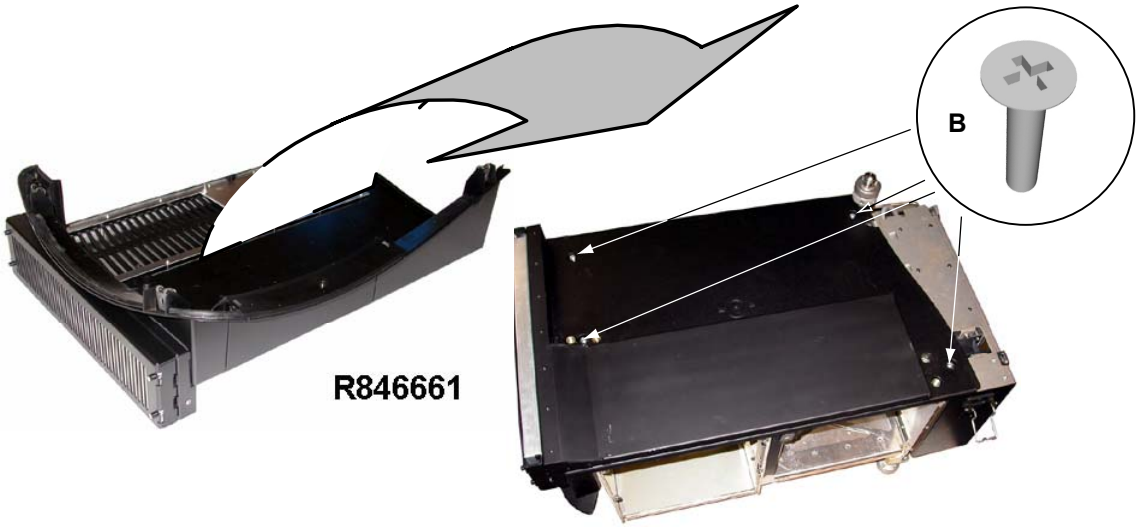


Image 28-17
Bottom cover mounting

2. Secure the bottom cover onto projector frame with 4 screws (B).

28.3.2.3 Mounting the Carrying handle fixation studs

How to mount

1. Place a spacer (B), added to the kit, on each stud fixation hole.

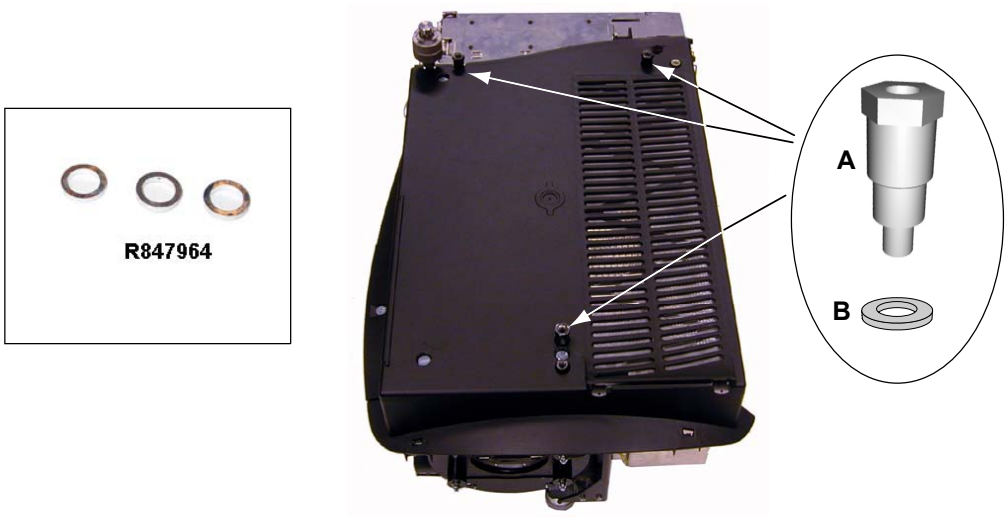


Image 28-18
Remount of carrying handle studs

2. Screw in the 3 fixation studs.

28.3.2.4 Mounting the Carrying Handle

Necessary tools

Allen Key of 8 mm .

How to mount

1. Place the carrying handle on the fixation studs, lining up the fixation holes (B) with the respective studs

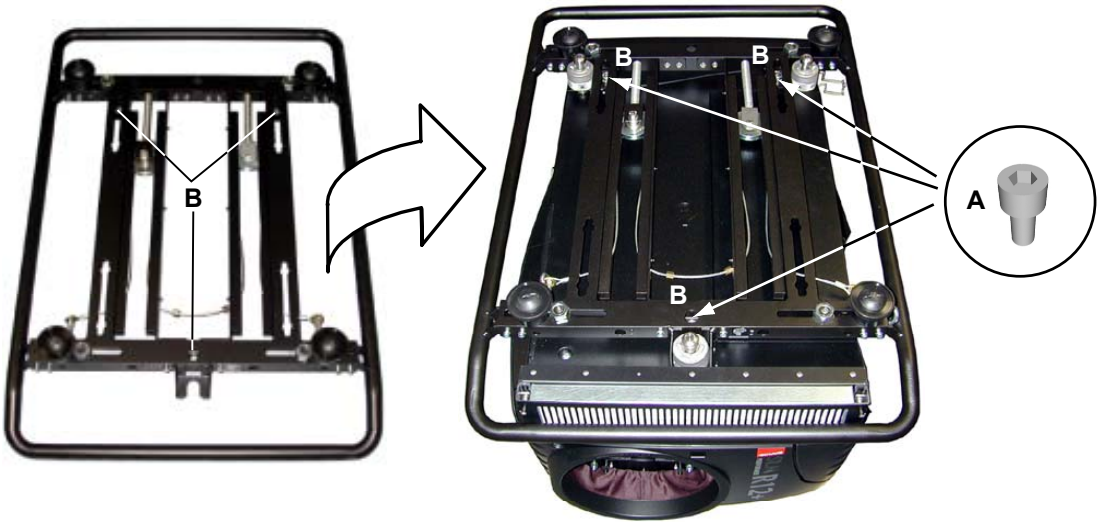


Image 28-19
Remount the carrying handle

2. Fix the carrying handle onto the studs with 3 screws (A).

28.3.2.5 Mounting the removed Stacking interlocks

How to mount

1. Fully screw the 2 stacking interlocks (A) in the projector base.

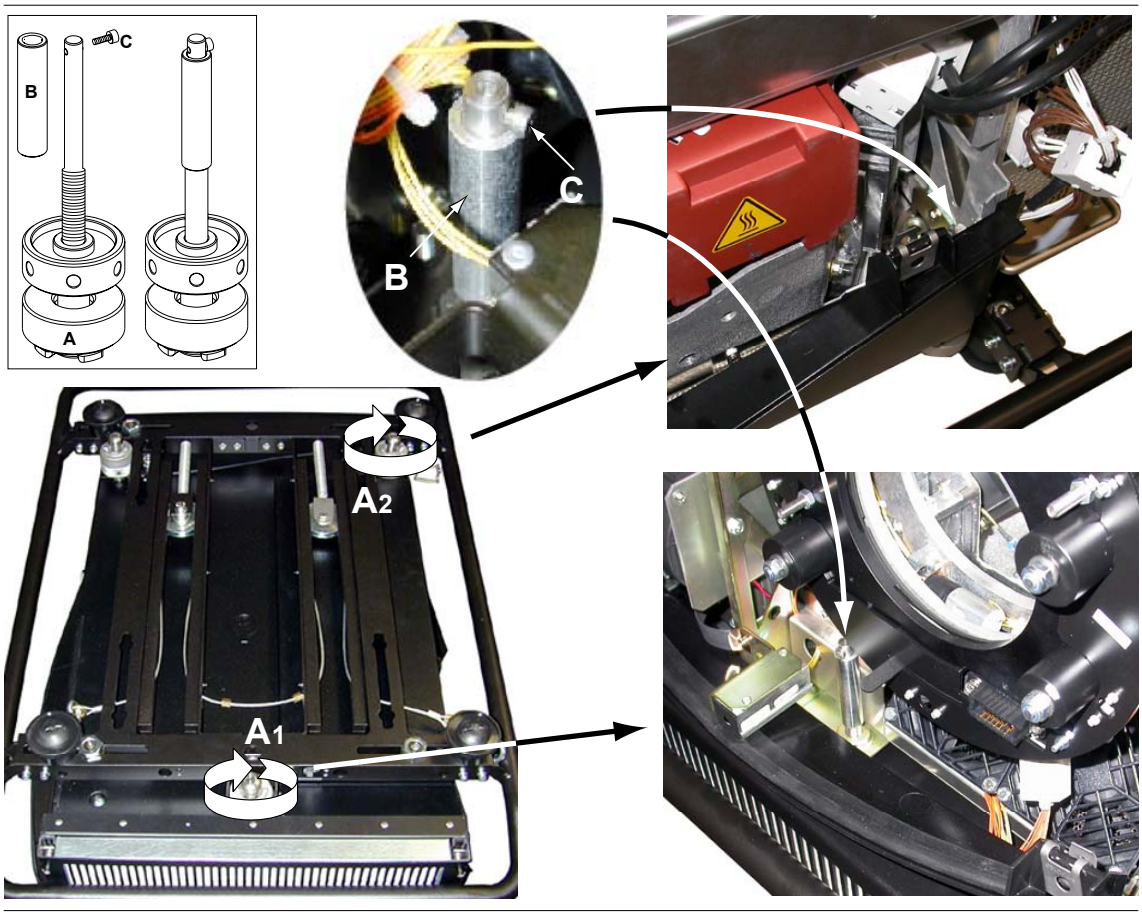


Image 28-20
Mounting the stacking interlocks

2. Slide the metallic tube (B) over the stacking rod, the longest tube on the front (A1) and the shortest on the side (A2) mounted stacking interlock.
3. Secure the tube from siding off when adjusting the stacking interlock by insertion of the screw (C) on top of the interlock rod.

28.3.2.6 Mounting the IR Receiver Unit

Why a new IR Receiver module

The air filters in the projector rear cover disables the built-in IR receiver. For that reason a new IR Receiver, revited on a metal plate, has to be mounted (added to the kit).

Necessary tools

- Open ended spanner 10 mm
- Torx T10
- Flat blade screwdriver 5 mm

Access for mounting

1. Disconnect the Lamp Power supply.

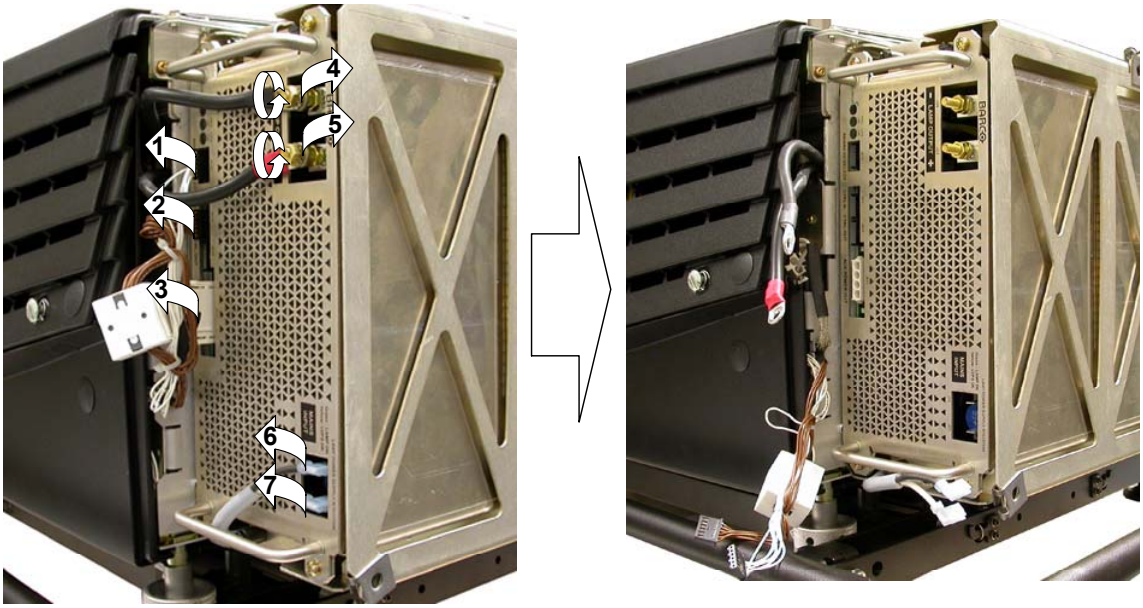


Image 28-21
Disconnecting the lamp power supply

2. Loosen, turning counterclockwise, the 2 rod screws on top (A) and the 2 rod screws at the bottom (B), securing the lamp power supply to its casing.

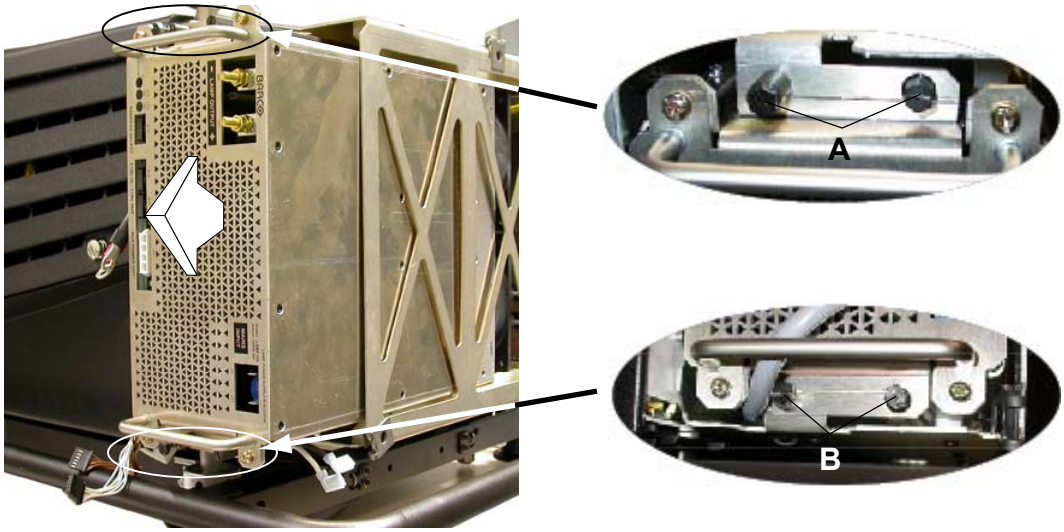


Image 28-22
Removing the lamp power supply from casing

3. Slide the lamp power supply out its casing.

Mounting the IR Receiver unit

1. Disconnect the built-in IR Receiver (B1).

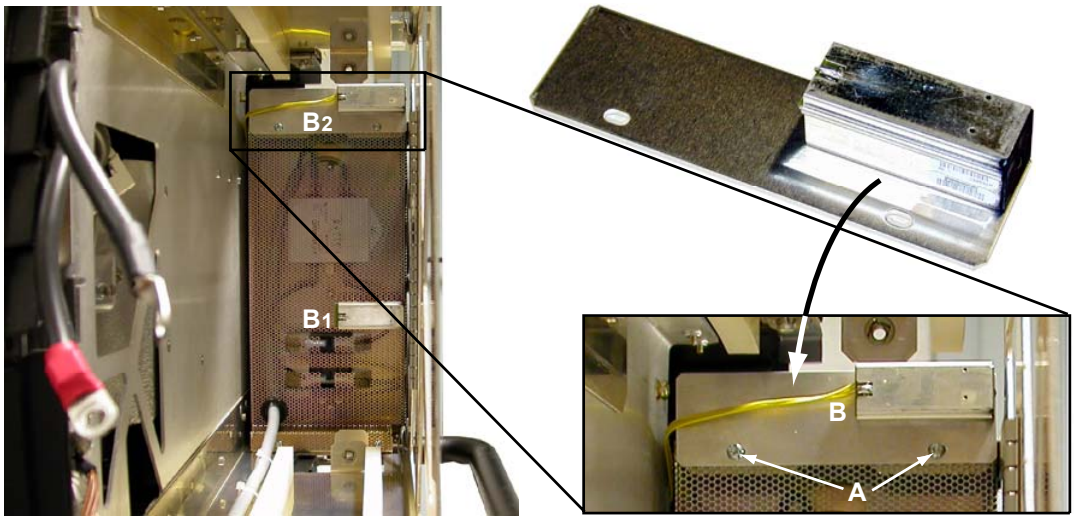


Image 28-23
IR Receiver mount

2. Mount the IR Receiver unit onto the power input screening, using 2 screws (A) of the screening fixation.
3. Connect the IR Receiver (B2).
4. Reinstall the lamp power supply.

28.3.2.7 Mounting the Bottom Cover with Air Filters

To be mounted previously

The following parts have to be mounted before proceeding to the installation of the rear cover with air filters.

- Top cover ("Removing the Top Cover", page 260)
- Lamp cover ("Removing the lamp cover", page 258)
- Input assembly ("Removing the Input Assembly", page 259)

How to mount

1. Place the rear cover with air filters (A) onto the back of the projector.

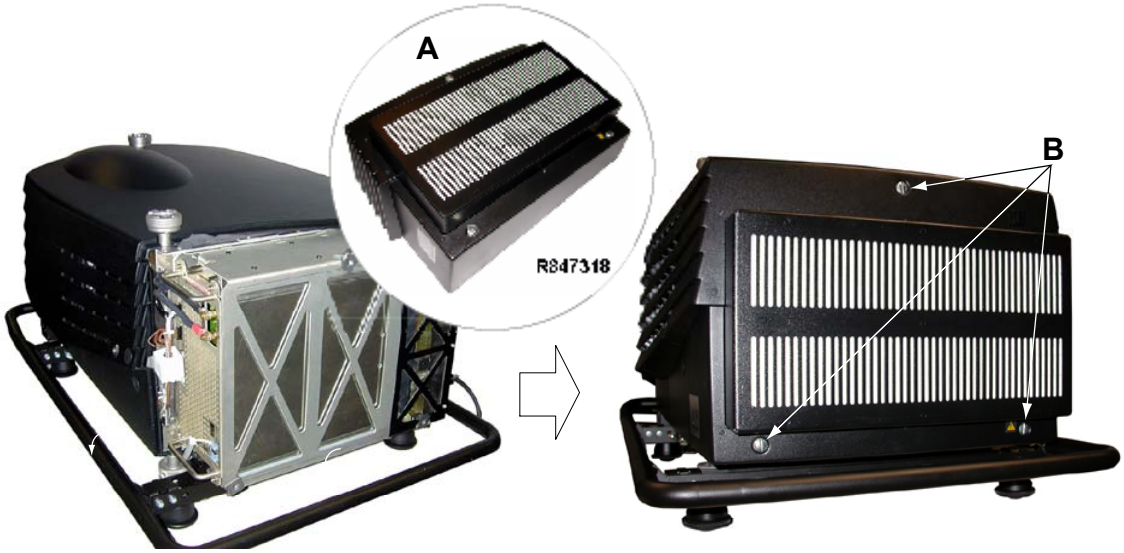


Image 28-24
Mounting the rear cover with air filters

2. Secure the cover on the projector frame by turning the 3 captive screws (B) a quarter turn clockwise.

29. OVERVIEW OF THE ELECTRICAL DIAGRAMS

29.1 Electrical Diagrams

Overview

The electrical diagrams are added to the manual in the order mentioned in the table below.

Article Number	Module description	
R763569_00	IR Transmitter	Link
R763223_00	Local Keypad+Display	Link
R763766_01	Communication Interface	Link
R763090_00	Communication Display	Link
R7632485_00	SDI Input	Link
R763850_05	Input Selection 1/2	Link
R763851_02	Input Selection 2/2	Link
R763826_00	Digital Decoder	Link
R763378_01	Backplane Digital Inputs	Link
R764239_02	Backplane Power Distribution	Link
R7632105_00	Lamp Power Supply-Xenon Processor /5	Link
R7632113_06	Lamp Power Supply-Xenon In/Out /3	Link
R763512_05	Start Pulse Generator	Link
R7632245S_04	Start Pulse Generator Drive	Link
R764349_01	Switch Mode Power Supply	Link
R764203_01	Temperature and Motor Control	Link
R764346_01	Formatter Interface	Link
R7638858_00	CPU	Link
R763261_02	IR Receiver Front/Rear	Link
R762790_00	Temperature Sensor	Link
R763294_00	Light Sensor	Link
R763295_00	Lamp Info	Link

A. SPECIFICATIONS

A.1 SLM R12+ P Specifications

Overview

Light Output	11500 ANSI lumens
Input source compatibility	1600 x 1200 (max. input)
Contrast ratio	1250 : 1 (full field)
Brightness uniformity	> 85%
Lamp	2.2 kW Xenon max. lifetime: 1200 hrs typ. lifetime: 800 hrs min. lifetime: 500 hrs
Seamless Switching	Standard (wipes, fades, ...)
ScenergiX	Standard horizontal and vertical electronic edge blending
Sealed DLP™ core	not available
Network connection	Optional (10 base-T)
Fixed Inputs	• 2x configurable 5 cable (BNC) (incl. 2 video decoders) • 2x DVI
Mains Voltage	200-240 V
Power consumption	2750 W
Weight	56 kg (124 lbs)
Dimensions (WxLxH)	585 x 876 x 429 mm
High contrast mode	1700 : 1 (full field)
Linked Constant Light Output	Standard
Light shutter	Standard
Picture-in-picture	2 sources simultaneous
Transition effects	Standard
Resolution	1400 x 1050 (native)
Noise level (@ 20°C - 68°F)	< 61.5 dBa
Noise level (@ 40°C - 104°F)	< 60 dBa
Ambient temperature	Max 35°C (95°F)
Lens encoders	On zoom and focus (with TLD lenses)
Modular inputs	**Standard:** 1x SDI (+ loop through) **Optional:** 1x HDSDI (+ loop through)

Control	• 1 x RS-232 / 422 IN • 1 x RS-232 / 422 OUT • 1 x XLR male (1 way) • 1 x XLR female (2 way) • build-in RF remote transceiver (optional) • com 800 • 10base-T (optional)
Fixed focal lenses	**Lens Throw ratio** TLD HB 0.8 0.75 TLD HB 1.2 1.1
Zoom lenses	**Lens Throw ratio** TLD HB 1.6 - 2.0 1.45 - 1.85 TLD HB 2.0 - 2.8 1.85 - 2.55 TLD HB 2.8 - 5.0 2.55 - 4.55 TLD HB 5.0 - 8.0 4.55 - 7.3
Order Information	Projector: R9010310 Spare lamp: R9841810 6-pack dust filters: R8454096K 24-pack dust filters: R84540924K
Dust filters	Dense, high quality microfilters available as spare kit, in a 6-pack & 24-pack
Noise level (@ ECO)	54,5 dBa

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Revision Sheet

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